No. 1 — *Revision of the Chinese Mecoptera*

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INTRODUCTION

The Mecoptera, commonly called scorpion flies and hanging flies, are widely distributed over the Northern Hemisphere and are well represented in China. However, little collecting of these insects has actually been done in China, especially in the interior regions. It was my good fortune to be a member of the entomological expedition of the Sino-British Committee, extending from June 1939 to July 1940; this was mainly restricted to Szechwan, Sikang and Shensi Provinces. The present study is based largely on specimens collected on this expedition. Since I have been able to examine type specimens in the Museum of Comparative Zoology, the U. S. National Museum and the Heude Museum, and also material in the Museum of the Institute of Zoology, Academia Sinica, Museum of Foochow University, Chou Collection, Issiki Collection and Maa Collection, I have included an account of all species described from China.

I wish to express my sincere thanks to all the curators of these museums and the owners of private collections for the loan and gift of material and for their kind coöperation which has made this study possible: Dr. P. J. Darlington, Dr. J. C. Bequaert, Museum of Comparative Zoology; Dr. A. B. Gurney, U. S. National Museum; Dr. Sieien H. Chen, Academia Sinica; Father de Cooman, Heude Museum; Dr. Hsiu Fu Chao, National Foochow University; Dr. Chou, Chang-chia-kang; Dr. S. Issiki, Tokyo and Mr. Maa, Taipeh.

Furthermore, I am deeply indebted to Professor F. M. Carpenter of Harvard University for his encouragement during the course of my study and for his kindness in reading over this paper.

HISTORICAL ACCOUNT

The order Mecoptera comprises about three hundred and thirty described species from the entire world. Until recently, only a few of them were known from China. In 1921, Esben-

Petersen recorded only eight species from there in his monographic revision of the order. In 1937, Wu reported nineteen species in his "Catalogus Insectorum Sinensium," fifteen species belonging to Panorpidae and four species to Bittacidae. In 1938, Carpenter listed twenty-eight species of Panorpidae. In the past ten years, more new species have been described by Carpenter, Tjeder and myself. The number of described species has thus been brought to fifty-seven. In the various collections which I have examined recently, twenty-five additional species have been found, bringing the total number of known Chinese species to eighty-two.

Because of its geographical nature, the mainland of China has been separated into thirty provinces. Scorpion flies and hanging flies occur in all those (about half) to which expeditions have been made. Since previous expeditions did not include most of the mountainous areas of any of the provinces and no expeditions at all have been made for Mecoptera in fifteen of the provinces, I believe our collections and knowledge of this order in China are still very incomplete.

SYSTEMATIC ACCOUNT

Of the five existing families of Mecoptera, only two have been found in China. They can be recognized as follows:

Tarsi with two claws, not raptorial.....Panorpidae
Tarsi with a single claw, modified for raptorial....Bittacidae

Family PANORPIDAE

Panorpidae Stephens, 1836, Ill. Brit. Ent., Enderlein, 1910, Zool. Anz., **25**: 385. Esben-Petersen, 1921, Coll. Zool. Selys Long., **5**(2): 11. Carpenter, 1931, Bull. Mus. Comp. Zool., **72**(6): 209.

Ocelli present; labial palpi two-segmented; abdomen cylindrical or nearly so, tapering to a point in the female, without ovipositor; 6th to 8th abdominal segments of male narrowly cylindrical, apical segment modified, usually enlarged; tarsi with two claws, not modified for grasping; wings more or less slender, with primitive venation; costal space narrow, with few crossveins; R_s originating at about one-third of wing length from base; M dividing near the middle of wing.

Three of the six existing genera of the family inhabit China, namely, *Panorpa*, *Neopanorpa* and *Leptopanorpa;* the fourth genus, *Panorpodes* occurs in Japan, the fifth *Apteropanorpa* in Tasmania, and the sixth, *Brachypanorpa* in North America. Both

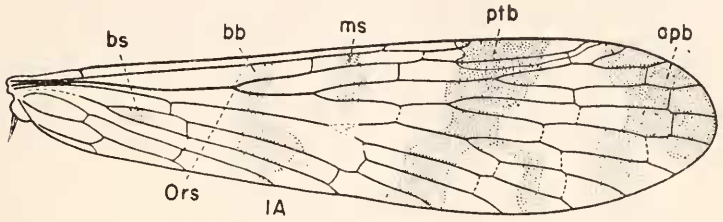

Fig. 1. Wing venation and markings of *Panorpa:* 1A, first anal vein; apb, apical band; bb, basal band; bs, basal spot; ms, marginal spot; Ors, origin of radial sector; ptb, pterostigmal band.

Panorpa and *Neopanorpa* were found in most of the Chinese provinces where expeditions have been made. *Leptopanorpa* is represented by a single species found in Hainan, Kwangtung. As a matter of fact, however, the latter locality is an island, separated from the mainland by the sea. The three genera occurring in

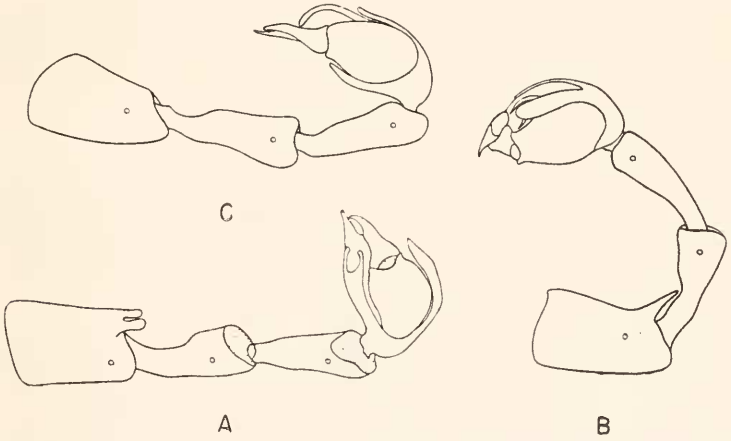

Fig. 2. The 6th to 9th abdominal segments of *Panorpa:* A, *kimminsi* Carpenter (*diceras* group); B, *obtusa* Cheng (*centralis* group); C, *cladocerca* Navas (*davidi* group).

China can be distinguished as follows:

1. 1A joins the anal margin of wing far beyond the origin of radial sector (text-fig. 1) ..... *Panorpa*
   1A joins the anal margin of wing before the origin of radial sector (text-fig. 3) 2
2. Abdomen in the male only as long as the wings or shorter; 6th to 9th abdominal segments normal or only a little prolongated (text-fig. 4) ..... *Neopanorpa*
   Abdomen in the male much longer than the wings; 6th to 9th segments much prolongated (text-fig. 5) ..... *Leptopanorpa*

Genus PANORPA Linné

Panorpa Linné, 1758, Syst. Nat., **10**:551. Klug, 1836, Abh. Königl. Akad. Wiss. Berl., 1836:88. Rambur, 1842, Hist. Nat. Ins. Nevr., 1842:328. Westwood, 1846, Trans. Ent. Soc. London, **4**:184. Loew, 1848, Linn. Ent., **3**:363. Brauer and Löw, 1857, Neuropt. Austr., 1857:35. Brauer, 1863, Verh. Zool.-bot. Ges. Wien, **13**:307. *Id.*, 1871, Verh. Zool.-bot. Ges. Wien. **21**:109. McLachlan, 1868, Trans. Ent. Soc. London, 1868:209. Klapálek, 1896, Rozp. Ceské Akad. Cisare Frantis. Josefa, 1896:1. Felt, 1896, New York State Ent. Rep., **10**:463. McClendon, 1906, Ent. News, 1906:121, fig. 14. Stitz, 1908, Zool. Jahrb., **26**:537. Mjöberg, 1909, Ent. Tidskr., 1909:160. Enderlein, 1910, Zool. Anz., **35**:389. Miyake, 1912, Journ. Coll. Agric. Imp. Univ. Tokyo, **4**:137. *Id.*, 1913, Journ. Coll. Agric. Imp. Univ. Tokyo, **4**:335. Banks, 1913, Trans. Am. Ent. Soc. 1913:232. Esben-Petersen, 1921, Coll. Zool. Selys Long., **5**(2):13. Carpenter, 1931, Bull. Mus. Comp. Zool., **72**(6):213.

Aulops Enderlein, 1910, Zool. Anz., **35**:390.

Estenella Navas, 1912, Rev. Russe d'Ent., **12**:356.

Rostrum long and slender; tarsal claws serrated on inner margins; wings are fully developed, rather broad, 1A long, extending to the anal margin of wing beyond origin of the radial sector; abdomen in both sexes not longer than the wings. 6th to 9th abdominal segments of male usual, not much prolongated; genital bulb of male not pedunculate basally.

Genotype: Panorpa communis Linné.

This is the largest genus of Mecoptera, including one hundred and sixty-two known species in the whole world. Thirty species have been already recorded in China and ten new ones are described below, making a total of forty. They are distributed throughout eleven provinces. As suggested by Carpenter (1938), these species can be conveniently divided into three groups, de-

pending upon the structure of the 6th abdominal segment of the male — that is, whether the anal horn is present, absent, or represented by two similar processes. In the first or *diceras* group, with double anal horn, belong *diceras* McLachlan, *tjederi* Carpenter, *stotzneri* Esben-Petersen and *kimminsi* Carpenter; in the second or *centralis* group, with a single anal horn, belong *centralis* Tjeder, *flavipennis* Carpenter, *emarginata* Cheng and *obtusa* Cheng; in the third or *davidi* group, without anal horn, belong *davidi* Navas, *stigmalis* Navas, *waongkehzengi* Navas, *difficilis* Carpenter, *fructa* Cheng, *cladocerca* Navas, *trifasciata*

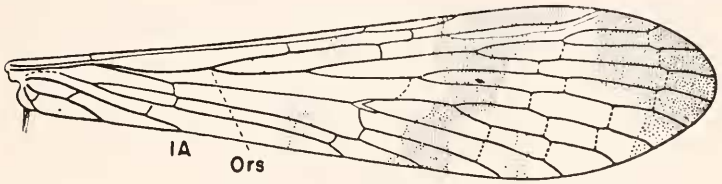

Fig. 3. Wing venation of *Neopanorpa:* 1A, first anal vein; Ors, origin of radial sector.

n. sp., *flavicorporis* n. sp., *cheni* n. sp., *obliqua* Carpenter, *baohwashana* n. sp., *typicoides* Cheng, *fukiensis* Tjeder, *curva* Carpenter, *aurea* n. sp., *coomani* n. sp., *japonica* Thunberg, *tetrazonia* Navas, *sexspinosa* Cheng, *tincta* Navas. Other species, *implicata* n. sp., *lutea* Carpenter, *klapperichi* Tjeder, *semifasciata* Cheng, *leei* Cheng, *grahamana* n. sp., *carpenteri* n. sp., *statura* Cheng, *pusilla* Cheng, *pieli* n. sp. and *bonis* Cheng, are known only from the female, so that their position in the above grouping is not determinable.

Other characteristics which have been used under each group of *Panorpa* are the wing markings and the general aspect of both male and female genitalia. The former characteristic sometimes appears to be similar from one species to another and in some cases passes through a little range of variation, while the latter remain perfectly stable even in minute details. In identification, therefore, I use the wing markings to assist in the first determination of the species and then the characteristics of both male and female genitalia for the final decision.

In the wings of *Panorpa,* the color of the membrane is a convenient feature for general classification. In some species, the wings are clear and colorless (*kimminsi,* fig. 271), in others they are distinctly yellow (*flavipennis*), and in some others, they are faintly yellow (*aurea,* fig. 281). The markings of the wings are readily grouped into several categories, depending upon how heavy the markings are. In some species, in which the wing is

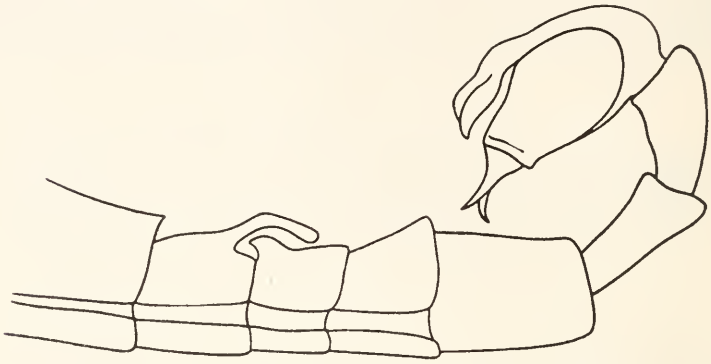

Fig. 4. Male abdominal segments of *Neopanorpa tienmushana* n. sp.

heavily marked (*japonica,* fig. 286), there are three transverse bands and two spots: these are designated the pterostigmal band, the basal band, the apical band, the basal spot and the marginal spot (text-fig. 1). In other species the wing is lightly marked, the bands are very narrow, the basal spot and the marginal spot are usually absent, and sometimes both pterostigmal and apical

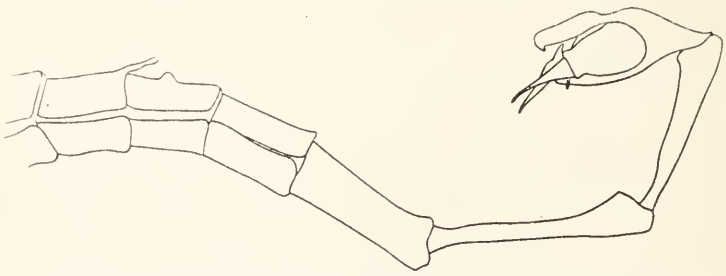

Fig. 5. Male abdominal segments of *Leptopanorpa javanica* (Westwood).

bands are interrupted or incomplete (*semifasciata,* fig. 274). In some other species, no markings are present, except for a slight suspicion of shadow at the wing apex (*obtusa,* fig. 272). Curiously enough, all species bearing the anal horn belong to the latter category, the only exception being *flavipennis,* which has a distinctly yellow wing membrane and very narrow basal, pterostigmal and apical bands. It is interesting to note that the single anal horn of this species is exceptionally short (fig. 13), quite different from the other single or double horn species. As worked out by Carpenter in his "Revision of the Nearctic Mecoptera" (1931), the venational characteristics of *Panorpa* are purely individualistic and could not be used for the classification of the species. The same statement applies to all the Chinese *Panorpa* from Fukien — the only locality from which sufficient specimens have been collected to allow a conclusion.

The male genital segment (or 9th segment), modified into a bulb, consists of an upper tergite (preëpiproct), a lower sternite (hypandrium) and a pair of two-segmented structures in between, the basal U-shaped coxopodites and the distal hooked harpagones. In some species there is a papilla at the inner distal margin of each of the coxopodites (*curva,* fig. 52, *davidi,* fig. 57), and in others a number of black spines at the same place (*sexspinosa,* fig. 87, *centralis,* fig. 10). The harpagones vary much in shape and degree of development; in most species there is a concave area on the inner basal surface of each harpagone (*centralis,* fig. 10, *davidi,* fig. 57). In others, instead of a concave area, there is an expansion or lobe at the same place. This lobe may be very small (*japonica,* fig. 90), greatly enlarged (*baohwashana* n. sp., fig. 83), or tooth-shaped (*diceras,* fig. 7), or it may arise at a different level (*trifasciata* n. sp., fig. 49, *cheni* n. sp., fig. 86). The preëpiproct is visible as a single external appendage from a dorsal aspect of the bulb. In most of the species, it has a pair of distal lobes (*diceras* etc., fig. 2), but in *waongkehzengi,* the lobes are so inconspicuous that the apex of the preëpiproct appears only slightly emarginated (fig. 43), and in *japonica,* no lobes occur at all, the preëpiproct terminating as a rounded posterior margin (fig. 85). The hypandrium appears as a basal plate from a ventral view of the bulb; this is usually produced into two long lobes, the hypovalvae. In some species

the hypandrium is long and stalk-like (*japonica*, fig. 90, *stigmalis*, fig. 33); in many others, it is inconspicuous (*emarginata* etc., fig. 31). The hypovalvae are generally slender and flattened (*flavipennis*, fig. 11), while in *baohwashana* n. sp., they are broadened towards the apex with upwardly folded outer margins (fig. 83). In the interior of the bulb, between the bases of the coxopodites arises an irregular aedeagus from the wall of the genital pouch. This usually has a pair of prominent apical processes and a pair of lateral processes. In some species, the apical processes are very short and inconspicuous (*tjederi*, fig. 6); in others, they are very long (*curva*, fig. 52), and in some others they have greatly enlarged distal ends (*difficilis*, fig. 46). At

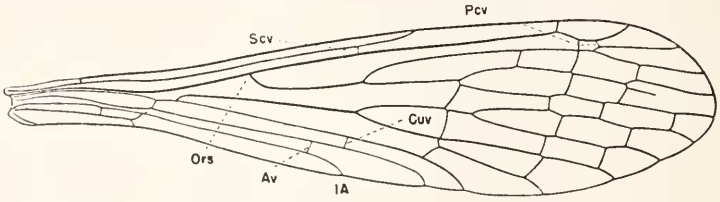

Fig. 6. Wing venation of *Bittacus:* 1A, first anal vein; Av, anal crossvein; Cuv, cubital crossvein; Ors, origin of radial sector; Pcv, pterostigmal crossvein; Scv, subcostal crossvein.

the sides of aedeagus are two slender parameres supported on a U-shaped bar in the ventral wall of the genital chamber proximal to the base of the aedeagus. The parameres exhibit a remarkable series of modifications in different species. They are strongly sclerotized and very stiff, usually blackish brown in color and with a cluster of spines, resembling the barbs in a bird's feather, on their inner margins and their distal ends. In some species the parameres are reduced to a very minute linear thread without spine (*japonica*, fig. 90), while in most others they are long with prominent barbs (*centralis* group, fig. 10, *davidi* etc., fig. 57). In some species, they are Y-shaped (*aurea* n. sp., fig. 62), in others they have 3-4 branches (*diceras* group, fig. 7). Curiously enough, even the extending direction and the approximate number of the spines of this appendage are constant in the species.

The female genital segment (or 9th segment) consists of an upper normally developed tergite and a lower subgenital plate which has a free posterior margin forming an opening for the genital cavity. In some species, the subgenital plate is very broad and its lateral margins overlap the sides of the 9th tergite (*tjederi,* fig. 12); others are narrow and their lateral margins are enclosed by the well developed 9th tergite (*semifasciata,* etc., fig. 122). The posterior margin of the subgenital plate differs from species to species. In *tetrazonia,* etc., it is narrowed towards the apex (fig. 93), in *leei,* etc., it is rounded (fig. 125), in most of the species, it is slightly emarginated (*kimminsi,* fig. 16) and in *japonica,* it has a V-shaped distal incision. Inside the genital cavity and just above the subgenital plate, there is a highly sclerotized internal skeleton. The latter shows a desired specific variability and individual constancy and has been used for identification by several authors for the past ten years. This plate is often supported by an inner pair of very dark pigmented rods or an axis. In most species, the axis is long and extends beyond the plate of the internal skeleton (*flavipennis,* etc., fig. 23), in others, it is less developed and confined by the plate (*tjederi,* etc., fig. 17), and in some others the axis is greatly reduced or absent (*japonica,* etc., fig. 100). Curiously enough, all the females of the *diceras* group have a small axis, i. e., slender and not extending beyond the plate of the internal skeleton. The above mentioned features of both male and female genital structures are constant in the individuals of each species, and show simultaneous modifications in the different species. They therefore serve as excellent characteristics for identification. The following keys to both male and female *Panorpa* are based mainly on these characteristics mentioned.

Key to the Males of Panorpa

The males of the following species are unknown: *lutea* Carpenter, *semifasciata* Cheng, *leei* Cheng, *statura* Cheng, *pusilla* Cheng, *pieli* n. sp., *bonis* Cheng, *klapperichi* Tjeder, *implicata* n. sp., *guttata* Navas, *grahamana* n. sp., *carpenteri* n. sp.

1. Sixth abdominal segment with anal horn 2
   Sixth abdominal segment without anal horn (text-fig. 2, C)..... ....(*davidi* group) 9

2. Sixth abdominal segment with double anal horn (text-fig. 2, A) ..... (*diceras* group) 3
   Sixth abdominal segment with single anal horn (text-fig. 2, B) ..... (*centralis* group) 6
3. Hypovalvae greatly broadened distally 4
   Hypovalvae slightly broadened distally 5
4. Tips of hypovalvae rounded; proximal lobes of the harpagones pointed (fig. 7) ..... *diceras*
   Tips of hypovalvae truncated; proximal lobes of the harpagones rounded (fig. 8) ..... *stotzneri*
5. Parameres four branched; preëpiproct with only shallow distal incision (figs. 1, 6) ..... *tjederi*
   Parameres three branched; preëpiproct with wide U-shaped distal incision (figs. 4, 9) ..... *kimminsi*
6. Genital bulb rounded; the outer margins of harpagones not concave at the middle 7
   Genital bulb less rounded; the outer margins of harpagones slightly concave at the middle 8
7. Coxopodites with a group of very strong black spine-like hairs on their inner apical margins; parameres simple, broad basally, abruptly tapering into a slender and acute distal portion (fig. 10) .... *centralis*
   Coxopodites without strong black spine-like hairs on their inner apical margins; parameres simple, stout, spindle-shaped (fig. 34) .... *obtusa*
8. Inner margins of harpagones without true lobes; hypovalvae rather broad, with slightly concave median outer margins; parameres long, with pointed apex, reaching to the distal part of harpagones (fig. 31) ..... *emarginata*
   Inner margins of harpagones with true lobes; hypovalvae very slender, with even outer margins; parameres short, with blunt apex, reaching only to the base of harpagones (fig. 11) ..... *flavipennis*
9. Wing membrane deeply yellow 10
   Wing membrane faintly yellow or hyaline 12
10. Wing markings distinct; basal band absent or represented by two separated spots 11
    Wing markings indistinct; basal band well developed, extending from subcostal to the anal margin of wing, broadened towards its posterior end; 6th to 8th abdominal segments as in figure 78 ..... *tincta*
11. Pterostigmal band absent; apical band broad, smoky brown; harpagones long and slender; hypandrium conspicuous, slender (fig. 33) ..... *stigmalis*
    Pterostigmal band present, with complete basal branch and separated apical branch; apical band interrupted; harpagones short; hypandrium conspicuous, broad (figs. 48, 277) ..... *waongkehzengi*

12. Pterostigmal band present but interrupted 13
Pterostigmal band present, not interrupted 14
13. Hypandrium rather conspicuous; apical processes of aedeagus very long, with greatly enlarged distal ends (fig. 46) ..... *difficilis*
Hypandrium inconspicuous; apical processes of aedeagus long, with narrow tooth-like distal ends and double sinuous outer margins (fig. 38) ..... *fructa*
14. Pterostigmal band with complete basal branch; apical branch absent 15
Pterostigmal band with both basal branch and apical branch..... 19
15. Basal band complete, not interrupted 16
Basal band interrupted, represented by two spots 17
16. Marginal spot present; inner margin of harpagones with a smooth median angle, a basal true lobe and a very large basal concave area (figs. 51, 284) ..... *cladocerca*
Marginal spot absent; inner margin of harpagones with a sharp median angle and a basal lobe which does not arise at the same level as the former (figs. 49, 283) ..... *trifasciata* n. sp.
17. Marginal spot present, and prominent; inner margin of harpagones with a smooth median angle and a broad basal lobe (fig. 59)..... ..... *flavicorporis* n. sp.
Marginal spot greatly reduced or absent; inner margin of harpagones with a sharp median angle and a basal lobe which arises at a different level or no true basal lobe at all 18
18. Parameres branched basally, the outer branch long, broadened towards apex; the inner branch short, with a bundle of long brown stiff hairs (fig. 86) ..... *cheni* n. sp.
Parameres simple, long and slender (fig. 57) ..... *davidi*
19. Apical branch of pterostigmal band interrupted, separated from pterostigmal band itself 20
Apical branch of pterostigmal band not interrupted, connected with pterostigmal band itself 23
20. Apical branch of pterostigmal band connected with the apical band to form a hyaline window which encloses a faintly brown spot; genital bulb as in figure 45 ..... *obliqua*
Apical branch of pterostigmal band not connected with the apical band 21
21. Harpagones very long and slender, inner margin with a broad basal lobe; hypovalvae narrow basally, very broad and robust distally; apex of preëpiproct usually folded downward, with very minute distal incision (figs. 83, 84) ..... *baohwashana* n. sp.
Harpagones short, no true basal lobe present; hypovalvae not broadened distally; apex of preëpiproct with very wide U-shaped distal incision 22

22. Parameres spindle-shaped distally; inner margin of harpagones with a sharp median tooth; apical processes of aedeagus simple (fig. 58) ..... *fukiensis*
Parameres long and slender; inner margin of harpagones with a smooth median angle; apical processes of aedeagus finger-shaped, their distal inner margins produced inwards to form a small nipple-shaped plate (figs. 36, 39) ..... *typicoides*
23. Apical branch of pterostigmal band broad, nearly the same width as the basal branch 24
Apical branch of pterostigmal band narrow, much narrower than the basal branch 26
24. Parameres simple, not branched; the distal inner margin of coxopodites with a very prominent papilla (fig. 52) ..... *curva*
Parameres Y-shaped; the distal inner margin of coxopodites without a papilla 25
25. Wing membrane light yellow, markings yellowish brown; harpagones with a long and large basal concave area; genital bulb slender, not elliptical (fig. 62) ..... *aurea* n. sp.
Wing membrane hyaline, markings sooty brown; harpagones with no concave area, but with median toothed basal lobe; genital bulb elliptical (fig. 63) ..... *coomani* n. sp.
26. Hypandrium conspicuous, appearing as a long narrow stalk; preëpiproct with rounded apex; harpagones long and slender; parameres very small, short rod-like (figs. 85. 90) ..... *japonica*
Hypandrium inconspicuous; preëpiproct with distal incision; harpagones not very long; parameres well developed 27
27. Inner margin of harpagones with prominent lobes; distal inner margin of coxopodites without prominent spines; parameres widening abruptly and giving rise to a long curved process which bears numerous long barbs (fig. 91) ..... *tetrazonia*
Inner margin of harpagones without true lobes, but with basal concave areas; distal inner margin of coxopodites with six prominent spines; parameres narrow and slender, without barbs (fig. 87) .... *sexspinosa*

Key to the Females of Panorpa

The females of the following species are unknown: *diceras* McLachlan, *obtusa* Cheng, *davidi* Navas, *curva* Carpenter, *difficilis* Carpenter, *fructa* Cheng, *coomani* n. sp., *stigmalis* Navas, *tincta* Navas.

1. Wing membrane deeply yellow 2
Wing membrane faintly yellow or hyaline or lacteous 5
2. Pterostigmal band complete, forked posteriorly 3
Pterostigmal band not complete, not forked posteriorly, apical branch

of pterostigmal band absent; apical band broad, with a large window; wing length less than 9 mm. (fig. 277) ..... *waongkehzengi*

3. Markings blackish brown, prominent; basal spot present; internal skeleton with a very short axis (fig. 112) ..... *lutea*
   Markings gray or brown; basal spot absent 4
4. Wing broad; markings brown; apical band large with a small hyaline spot (fig. 279) ..... *statura*
   Wing narrow; markings gray; apical band reduced to a few faint spots ..... *flavipennis*
5. Pterostigmal band absent 6
   Pterostigmal band present 9
6. Internal skeleton with short axis, not extending beyond the plate 7
   Internal skeleton with long axis, usually extending beyond the plate 8
7. Subgenital plate not emarginated distally; internal skeleton as in figure 18, with somewhat converging posterior arms; wing membrane with faintly yellowish tinge; tip of wing bordered with strong yellowish brown ..... *stotzneri*
   Subgenital plate slightly emarginated distally; internal skeleton as in figure 19, with somewhat diverging posterior arms; wing membrane dusky hyaline; tip of wing bordered with grayish yellow (fig. 271) ..... *kimminsi*
8. Internal skeleton as in figure 24, axis extending beyond the plate one half its length ..... *emarginata*
   Internal skeleton as in figure 20, axis extending beyond the plate less than one half its length ..... *centralis*
9. Pterostigmal band not prominent, represented only by a spot posterior to the pterostigma 10
   Pterostigmal band prominent 11
10. Wings subobtuse; apical band absent; pterostigma smoky; internal skeleton as in figure 17, with posterior arms extending parallel to each other ..... *tjederi*
    Wings narrow and slender; apical band present, interrupted, represented by three separated spots; pterostigma yellow. ..... *guttata*
11. Pterostigmal band with only basal branch 12
    Pterostigmal band with both basal branch and apical branch 19
12. Basal branch of pterostigmal band narrow 13
    Basal branch of pterostigmal band the same width as the pterostigmal band itself 15
13. Both basal band and marginal spot present; subgenital plate long and slender; internal skeleton small, as in figure 69. ..... *flavicorporis*
    Both basal band and marginal spot absent 14

14. Basal branch of pterostigmal band interrupted; internal skeleton as in figure 114 ..... *semifasciata*
Basal branch of pterostigmal band not interrupted; internal skeleton as in figure 127 ..... *leei*
15. Subgenital plate with less sclerotized lateral plates; both sides of the subgenital plate enclosed by the lateral borders of the 9th tergite 16
Subgenital plate without lateral plates; both sides of the subgenital plate are free 17
16. Rostrum brownish black in color, with an orange median longitudinal stripe; the anterior arms of the internal skeleton slightly outwardly curved as in figure 115 ..... *grahamana* n. sp.
Rostrum uniformly reddish brown, no median longitudinal stripe; the anterior arms of the internal skeleton folded transversely at its median portion as in figure 116 ..... *carpenteri* n. sp.
17. Subgenital plate slender, narrow basally; internal skeleton as in figure 68 ..... *cladocerca*
Subgenital plate somewhat triangular, broad basally 18
18. Subgenital plate with slightly emarginated apex; internal skeleton as in figure 96 ..... *cheni* n. sp.
Subgenital plate with rounded apex; internal skeleton as in figure 65 ..... *trifasciata* n. sp.
19. Apical branch of pterostigmal band interrupted, separated from pterostigmal band itself 20
Apical branch of pterostigmal band not interrupted, connected with pterostigmal band itself 27
20. Apical branch of pterostigmal band large, united with the apical band to form one or two hyaline spots 21
Apical branch of pterostigmal band small, simple, separated from the apical band 22
21. Wing membrane faintly yellow; subgenital plate with rounded posterior margin; internal skeleton as in figure 98, with short axis .... *obliqua*
Wing membrane hyaline, subgenital plate with slightly concave posterior margin; internal skeleton as in figure 103, with very long axis.... ..... *implicata* n. sp.
22. Wing membrane light yellow; fore wing length less than 11 mm. ..23
Wing membrane hyaline; fore wing length more than 12 mm. 24
23. Wing markings sooty brown; internal skeleton with small plate as in figure 118 ..... *pusilla*
Wing markings gray; internal skeleton with large plate as in figure 117 ..... *pieli* n. sp.

24. Fore wing length more than 18 mm.; subgenital plate with prominent V-shaped distal incision; internal skeleton as in figure 105, with nearly straight axis ..... *baohwashana* n. sp.
Fore wing length less than 16 mm.; subgenital plate with no prominent V-shaped distal incision; internal skeleton with outwardly curved axis 25
25. Internal skeleton with long axis, extending nearly two-thirds its length beyond the plate as in figure 67 ..... *typicoides*
Internal skeleton with short axis, extending not more than half its length beyond the plate 26
26. Apical band prominent, large; basal band complete; apex of subgenital plate not emarginated; axis of internal skeleton simple, as in figure 71 ..... *fukiensis*
Both apical band and basal band interrupted; apex of subgenital plate slightly emarginated; distal ends of the axis of internal skeleton branched as in figure 106 ..... *bonis*
27. Apical branch of pterostigmal band broad, nearly the same width as the basal branch 28
Apical branch of pterostigmal band narrow, much narrower than the basal branch 29
28. Wing membrane light yellow, markings yellowish brown; internal skeleton large, as in figure 77, with long outwardly curved axis extending beyond the plate one half its length ..... *aurea* n. sp.
Wing membrane hyaline, markings sooty brown; internal skeleton small, as in figures 120, 121, with very short axis not extending beyond the plate ..... *klapperichi*
29. Internal skeleton as in figure 100, no axis present ..... *japonica*
Internal skeleton with well developed axis 30
30. Wing membrane hyaline; internal skeleton as in figure 124, posterior arms short, pointed towards apex ..... *sexspinosa*
Wing membrane with slightly yellowish tinge; internal skeleton as in figure 94, posterior arms long, with rounded apex ..... *tetrazonia*

Descriptions of Species of Panorpa

Panorpa diceras McLachlan

Figures 2, 7

Panorpa diceras McLachlan, 1894, Ann. Mag. Nat. Hist., (6)**13**:423. Esben Petersen, 1921, Coll. Zool. Selys Long., **5**(2):36. Tjeder, 1936, Ark. för Zool., **27** A (33):9, pls. 4, 5, 7, figs. 4, 5. Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9): 270, figs. 2, 10, 11. *Id.*, 1948, Psyche, **55**(1): 28, fig. 1.

Panorpa grahami Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9):272, figs. 5, 9.

Body light brown; vertex with a black spot around ocelli; rostrum with black stripe on each side; thorax and abdomen with a lateral black stripe; sixth abdominal segment of male with two short anal horns. Fore wing: length, 11 mm.; width, 3.5 mm.; membrane hyaline without markings except for a slight suspicion of gray at the apex; neuration distinct, Sc extends to the pterostigmal area, R_2 is forked and R_1, R_3, R_4, R_5 are simple, usually one crossvein occurring between R_1 and R_2. Hind wing: similar to the fore wing. Male genitalia: genital bulb rounded; coxopodites rather long; harpagones slender, the outer margin slightly concave at the middle, the inner margin with a small distal lobe and a larger pointed proximal lobe; hypandrium inconspicuous, hypovalvae long, reaching to the base of the harpagones, narrowed proximally, much broadened distally, with rounded tips; parameres complex, each consisting of a narrow basal stalk, which gives rise to three branches, pectinately arranged, the basal branch being the shortest, the others about equal; preëpiproct with prominent distal lobes, the incision being almost quadrate.

Female unknown.

Type (♂): Tachienlu, Sikang; in McLachlan Collection.

Distribution: Tachienlu, Sikang; 9 miles south of Tachienlu, Sikang (8500-13,000 ft.), June 25-27, 1923 (D. C. Graham).

This species, which has double anal horns in the male, belongs to the *diceras* group. I have not seen the type. According to Carpenter's drawing, this species resembles *stotzneri* Esben-Petersen in general appearance. However, the rounded tips of the hypovalvae and the pointed proximal lobes of the harpagones make its recognition easy.

Panorpa tjederi Carpenter

Figures 1, 6, 12, 14, 17

Panorpa tjederi Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9):271.
Panorpa diceras Tjeder (*nec* McLachlan), 1936, Ark. för Zool., **27** A (33):9, pls. 4, 5, pl. 7, figs. 4, 5.

According to Tjeder, the body characters of the male of this species agree wholly with McLachlan's original description for *Panorpa diceras* McLachlan. In the characteristics in size, color of head, body and legs, and shape of wings, the ♀ agrees perfectly with the ♂. The color of the wings is distinctly different.

Besides the smoky pterostigma, there is a subtriangular smoky brown oblique spot, extending from the pterostigma down into the cellula between R_5 and M_{1+2} (just before the fork-point). The additional side plates of the 7th to 8th abdominal segments are wholly absent, the tergites are comparatively narrow while the sternites are very broad (with their lateral margins reaching up to the dorsal surface), and the pleural regions are very narrow and situated latero-dorsally. The detail drawings of both ♂ and ♀ genitalia were given by Tjeder. According to these drawings, the genital bulb of ♂ genitalia is oval; coxopodites rather long, U-shaped; harpagones very broad at the base but strongly tapering into a very acute and hooked, curved apex, the outer margin slightly concave at the middle, the inner margin with a median small tooth-like process and a large basal tooth directed inwards; hypandrium inconspicuous; hypovalvae slender, slightly broadened and diverging towards each other in the distal half, reaching to the base of the harpagones; parameres complex, each consisting of a narrow basal stalk, which gives rise to four branches; one of these arises inwardly from about the middle of the stalk, the others arise further distally and continue nearly straight; preëpiproct broad, narrowed towards apex, which is broadly emarginated; aedeagus smoothly emarginated distally, both apical and lateral processes inconspicuous. Female genitalia: the subgenital plate is very broad, and its lateral margins overlap the sides of the 9th tergite; at the hind margin the plate appears broad and tongue-like, extending through this tongue-like process farther backwards than the 9th tergite; internal skeleton very broad, posterior arms of the plate blunt and stout, strongly folded, leaving between them proximally a smoothly rounded space; axis short, lying wholly within the plate and ending behind the basal flaps of the plate, which are very large, and lie close to one another, with their apical ends directed upwards.

Types (♂, ♀): Yunnan (George Forrest); in K. J. Morton Collection, Edinburgh.

Distribution: same as types.

This species belongs to the *diceras* group. I have not seen the types. According to Tjeder's drawings, it is closest to *diceras* McLachlan in general appearance. However, the hypovalvae are

not broadened towards the apex as in those of *diceras*. The parameres of this species are apparently four-branched, whereas those of *diceras* are only three-branched. According to Tjeder, the wings of the female of this species show great similarity to those of *Panorpa bicornuta* McLachlan (from Japan), as figured by Esben-Petersen, but the female genitalia of this species are very different from those of *bicornuta*.

Panorpa stotzneri Esben-Petersen

Figures 8, 15, 18

Panorpa stotzneri Esben-Petersen, 1934, Vidensk. Medd. Dansk Naturh. Foren., **97**:211, figs. 1, 2. Tjeder, 1936, Ark. för Zool., **27** A (33):11, pl. 6.

Body mostly lemon-colored; vertex with a black spot, enclosing the ocelli; rostrum with two brownish-black longitudinal streaks; thorax with a black longitudinal streak along each margin; 1st to 5th abdominal segments of male lemon-colored, with a black streak along each margin, last few abdominal segments with indication of a darker color; the hind border of third tergite produced in a short lobe; sixth segment somewhat swollen, and its hind margin above produced in two club-shaped anal horns; abdomen of female yellowish, with a black streak along each side. Fore wing: length, 17 mm., membrane faintly yellowish tinged, tip of the wings strongly bordered with yellowish brown; venation blackish brown, Sc reaching to the pterostigma, which is prominent. Hind wing: length, 15 mm., similar to the fore except that Sc reaches only half way to the pterostigma. Male genitalia: according to Esben-Petersen's drawing, the genital bulb is rounded; coxopodites rather short, harpagones slender, each with pointed and inwardly curved apex, the outer margin very slightly concave at the middle, the inner margin with a sharp median tooth and a rounded proximal lobe; hypandrium inconspicuous; hypovalvae greatly broadened towards truncated apex, and nearly reaching to the base of the harpagones; parameres apparently three-branched according to Esben-Petersen's drawing, but unfortunately the structure is not completely shown. The female genitalia have been worked out by Tjeder. The additional side-plates of the 7th segment are large

and apically grown together with the 7th tergite. The additional side-plates of the 8th segment are wholly grown together with the 8th tergite, which thus appears much broader (in lateral view) behind the spiracle than before it; the 7th and 8th sternites are comparatively narrow and appear in lateral view as narrow borders only; the 9th tergite is longer than the 8th segment; subgenital plate appears broadly oval with tip slightly produced, smoothly rounded; distally the plate bears several strong black setae; internal skeleton rather large, the plate broadened near the base, posterior arms well developed, long, rounded and somewhat converging, the axis very short and situated wholly within the plate.

Type (♂): Kwanhsien, Szechwan (W. Stötzner); in Esben-Petersen's Collection, Silkeborg. Type (♀): Wolungkwan, Szechwan, 55 km. west of Kwanhsien, Szechwan and 150 km. northeast of Tachienlu, Sikang (W. Stötzner); in Staatliches Museum für Tier- und Völkerkunde, Dresden.

Distribution: same as types.

This species belongs to the *diceras* group. I have not seen the types. According to Esben-Petersen's and Tjeder's drawings, it is closest in general appearance to *Panorpa diceras* McLachlan. However, the hypovalvae, though broadened distally as in *diceras*, are truncated distally, whereas those of *diceras* have a rounded apex. The proximal lobes of the harpagones of this species are rounded, not pointed as in *diceras*. Unfortunately, Esben-Petersen's drawing of the male type does not show details of the structure of the parameres or of the aedeagus.

Panorpa kimminsi Carpenter

Figures 4, 9, 16, 19, 271

Panorpa kimminsi Carpenter, 1948, Psyche, **55**(1):29.

Panorpa diceras Carpenter (*nec* McLachlan), 1938, Proc. Ent. Soc. Washington, **40**(9):270, figs. 2, 10, 11.

Body yellow; vertex with black area in the region of the ocelli and between the antennal bases; rostrum with a black stripe along each side; eyes grayish brown; thorax and abdomen yellow, with a black stripe laterally, 6th abdominal segment of male with a pair of short anal horns, as in *diceras*. Fore wing: length, 15-18 mm.; width, 4 mm.; membrane dusky hyaline, with grayish

yellow at the apex; pterostigma deep yellow, prominent; neuration as in *diceras*. Hind wing: length, 13-15.5 mm.; width, 4 mm.; similar to fore wing. Male genitalia: genital bulb oval; coxopodites U-shaped; harpagones slender, the outer margins smoothly curved, inner margins with two teeth, a small distal one and a long, slender, proximal one; hypandrium inconspicuous, hypovalvae prominent, only very slightly broadened distally, reaching to the base of the harpagones; parameres complex, consisting of a slender basal stalk, which gives rise to three branches, a small one on the inner side, a long middle branch, which extends well up between the harpagones, and a shorter outer branch, which curves inwardly in back of (i.e., above) the second branch; preëpiproct broad, with long distal lobes; aedeagus with rounded apical processes and rounded lateral processes. Female genitalia: posterior border of subgenital plate rounded, slightly emarginated; internal skeleton small, the axis very small, not projecting beyond the plate; the plate attached to a chitinous, hood-shaped membrane, which extends slightly beyond the axis.

Holotype (♂): Mt. Omei (11,000 ft.), Szechwan, July, 1936 (D. C. Graham); in U. S. National Museum. Allotype (♀): near Tachienlu (5000-8500 ft.), Sikang, June 18- July 12, 1923 (D. C. Graham); in U. S. National Museum.

Distribution: Vicinity of Tachienlu, 30 miles north of Tachienlu (12,000 ft.), 9 miles southwest of Tachienlu (9000-11,000 ft.), Sikang, June 5-27, 1923; west of Yachow (2000-7500 ft.), Sikang, June 14-18, 1922; Omei (11,000 ft.), Szechwan, July, 1936; Suifu, Szechwan, Oct., 1929.

This species belongs to the *diceras* group. It is the most widely distributed of all the double anal horn species. It differs from the other species by the curved harpagones and the peculiar configuration of the parameres of the male. It should be noted that the structure of both the subgenital plate and the internal skeleton of the female is very similar to that of *stotzneri* Esben-Petersen.

Panorpa centralis Tjeder

Figures 5, 10, 20, 21

Panorpa centralis Tjeder, 1936, Ark. för Zool., **27** A (33):3, pls. 1, 2, 7, figs. 1, 2.

Body mostly black; vertex and frons deep black; rostrum shining dark piceous with somewhat lighter margins, apically a little darker; prothorax black with narrow yellowish side-margins, meso- and metathorax deep-black dorsally, pleura and underside of thorax reddish yellow; 1st to 6th abdominal segments of male deep black, last few abdominal segments fuscous; anal horn present, single, brownish, directed obliquely upwards; the third tergite in the middle of its hind-border develops into a very small rounded lobe; abdominal segments of female deep black, 7th and 8th segments with long narrow additional anal plates in the pleural region behind the spiracle. Fore wing: length, 13 mm.; width, 3 mm.; membrane hyaline, with a faintly whitish tinge in male, more yellowish brown in female; wings of male without markings, while those of female with spots between R_5 and M_1 and at the place where Cu_1 reaches the hind margin; pterostigma whitish, faintly indicated in male, but distinct and light-brown in female; neuration distinct; Sc extends to the pterostigmal area, R_2 is forked, and R_1, R_3, R_4, R_5 are simple; usually one crossvein between R_1 and R_2. Hind wing: length, 12 mm.; width, 3 mm.; similar to the fore. Male genitalia: genital bulb rounded; coxopodites long, with a group of strong and black, spine-like hairs on their inner apical margins; harpagones short, ending in an acute apex, bent slightly inwards, the outer margin not concave at the middle, the inner margin having a dilatation midway between base and apex; the under surface shows a distinctly rounded excavation; hypandrium inconspicuous; hypovalvae rather narrow, not reaching to the base of the harpagones, their borders straight and running parallel; along their inner margins they bear a row of long and strong black hairs, directed inwards; parameres simple and short; in their proximal part they are very broad, but a short distance behind the middle of their length they suddenly taper into a slender and acute distal portion, which on the inner margin bears a dense row of lamellae, directed obliquely inwards; preëpiproct narrowed towards apex with a U-shaped distal incision; aedeagus with very long and acute apical processes, lateral processes short, blunt tooth-like. Female genitalia: subgenital plate oval with smoothly rounded side-margins, which overlap the lower margins of the 9th tergite to a very little extent; its apex has a very small excision; in-

ternal skeleton large, but rather narrow, with a pair of short, blunt, posterior arms; on each side of the proximal part of the plate, there are three lamellae directed forwards and inwards, ending acutely and having the apices of the two inner pairs bent somewhat outwards; the axis is long, extending more than one third its length beyond the plate, the proximal ends almost unpigmented, deeply cleft and directed slightly outwards.

Holotype (♂): Pao-ning-fu (400 m.), northeast Szechwan, May 20, 1930 (D. Hummel); in Stockholm Museum. Allotype (♀): Tjeggala (3700 m.), Sept. 4, 1930 (D. Hummel); in Stockholm Museum.

Distribution: same as types.

This species, which has a single anal horn in the male, belongs to the *centralis* group. It resembles in general appearance *Panorpa cornigera* McLachlan, which belongs to the *cornigera* group, as established by Issiki. However, many parts of the male and female genitalia and especially the shape of the parameres and that of the apical processes of the aedeagus make it easily recognized as a distinct species.

Panorpa emarginata Cheng

Figures 24, 25, 27, 31, 32, 273

Panorpa emarginata Cheng, 1949, Psyche, **56**(4):140, figs. 1, 11, 12, 24, 26, 29.

Vertex entirely black; rostrum grayish brown anteriorly, yellowish brown laterally; thorax yellowish brown laterally, pronotum blackish brown, meso- and metanotum entirely pitchy black; the 1st to 6th abdominal segments pitchy black dorsally and ventrally, last few abdominal segments yellowish brown; 6th abdominal segment of male with a single anal horn, yellowish brown in color. Fore wing: length, 14 mm.; width, 3.5 mm.; membrane hyaline, without markings except for a slight suspicion of gray at the apex; pterostigma prominent, indicated by light brown color; the dorsal hind margin of wing slightly emarginated. Hind wing: length, 12.5 mm.; width, 3.5 mm.; similar to fore wing. Male genitalia: genital bulb less rounded; coxopodites long, broadened towards its apex; harpagones short, the outer margin slightly concave at the middle, inner margin

with a median small triangular tooth and a large basal concave area; hypandrium inconspicuous; hypovalvae long, with slightly concave median outer margins, extending nearly to the base of the harpagones; parameres simple and long, usually reaching to the distal part of harpagones, each consisting of a single stalk, which broadens at the middle and becomes very long and sharp distally, bearing a series of long barbs at its distal inner margin; preëpiproct narrowed towards apex, with nearly straight sides and a narrow U-shaped distal incision; aedeagus with very long apical processes and prolonged lateral processes, the distal inner margin of the former usually with a broad triangular plate. Female genitalia: subgenital plate elongated, emarginated posteriorly, the incision being very small; internal skeleton large, the plate concave at the middle, with a pair of sharp distal posterior arms and two pairs of small basal side plates; the axis long, extending beyond the plate one-half its length.

Holotype (♂): Mt. Hwa, Shensi, June, 1942 (Io Chou); in Museum of Comparative Zoology. Allotype (♀): same collecting data as holotype; in Cheng Collection, Taipeh.

Distribution: same as types.

This species, possessing a single anal horn, belongs to the *centralis* group, with the wing membrane transparent as in *centralis* Tjeder. The wing apex of *centralis* Tjeder is colorless, whereas that of *emarginata* is maculated with a slight suspicion of gray. The male genitalia differ from those of *centralis* by the less rounded genital bulb and the longer and sharper parameres.

Panorpa obtusa Cheng

Figures 28, 34, 37, 272

Panorpa obtusa Cheng, 1949, Psyche, **56**(4):142, figs. 2, 25, 27, 30.

Vertex entirely black; rostrum reddish brown, with a weakly defined grayish stripe on each side; thorax reddish brown laterally, entirely black dorsally; the 1st to 6th abdominal segments black dorsally and ventrally, last few abdominal segments of male reddish brown; the hind border of the third tergite of male prolonged into a small semicircular process, 6th abdominal segment furnished with a single anal horn, reddish brown in color.

Fore wing: length, 14 mm.; width, 3.55 mm.; membrane light grayish brown, without markings except for a slight suspicion of grayish brown at the apex; pterostigma prominent, indicated by grayish brown color; the wing apex obtuse, broader than in the preceding species. Hind wing: length, 13 mm.; width, 3.5 mm.; similar to fore wing. Male genitalia: genital bulb rounded, coxopodites long; harpagones short and stout, the outer margin smoothly curved, the inner margin with a greatly reduced median tooth (which cannot be seen from ventral view) and a large basal concave area; hypandrium inconspicuous; hypovalvae rather straight, reaching nearly to the base of the harpagones; parameres simple and stout, usually not extending beyond the tips of coxopodites, each consisting of a single spindle-shaped stalk, formed by the outer strongly sclerotized part; the distal inner margins of parameres furnished with a series of long barbs; preëpiproct slightly narrowed towards apex, with a wide U-shaped distal incision; aedeagus with small lateral processes and a pair of long apical processes, the inner margins of the latter nearly parallel to each other.

Female unknown.

Holotype (♂): Mt. Taipai, Shensi, July 14, 1943 (Chuan Lung Lee); in Cheng Collection, Taipeh.

Distribution: same as types.

This species belongs to the *centralis* group, having the same wing markings as *emarginata*, but the body color and the structure of the male genitalia, especially the short parameres, make its recognition easy.

Panorpa flavipennis Carpenter

Figures 3, 11, 13, 22, 23

Panorpa flavipennis Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9):268, figs. 3, 7, 12.

Body black; vertex entirely black; rostrum reddish brown; last few abdominal segments of male reddish brown, single anal horn on 6th abdominal segment very short, 7th segment moderately incised above. Fore wing: length, 13-14 mm.; width, 3 mm.; membrane deep yellow, markings gray; pterostigmal band usually complete or nearly so; basal band interrupted; apical

band reduced to a few faint spots; both basal and marginal spots absent; pterostigma dark red, very prominent; crossveins not margined. Hind wing: similar to fore wing, except that basal band is entirely lacking. Male genitalia: genital bulb less rounded; coxopodites rather long; harpagones slender, with the outer margins slightly concave proximally, and a pair of longer lobes distally, the ventral lobe having a smoothly curved margin, the dorsal one an abruptly curved margin; hypandrium inconspicuous, hypovalvae very slender, almost reaching to the base of the harpagones; parameres simple, each consisting of a single broad flat process bearing on its inner distal margin a number of distinct barbs; preëpiproct with curved sides and a moderately deep, U-shaped incision distally; aedeagus with rather sharp horn-like apical processes and rounded lateral processes. Female genitalia: subgenital plate slender, slightly emarginated distally; internal skeleton large, the axis extending beyond the plate for nearly half its length.

Holotype (♂): Beh-luh-din (6000 ft.), 30 miles north of Chengtu, Szechwan, Aug. 11, 1933 (D. C. Graham); in U. S. National Museum. Allotype (♀): same collecting data as holotype except for date: Aug. 8, 1933; in U. S. National Museum.

Distribution: Beh-luh-din (6000 ft.), 30 miles north of Chengtu, Szechwan; July 12 to Aug. 27.

This species, possessing a single anal horn, belongs to the *centralis* group. At present, there are four known species in this group. The wing membrane of *flavipennis* is deep yellow, whereas that of the other three species is colorless, lacteous or grayish brown. The male genitalia differ from those of the other three species in the more slender hypovalvae and the possession of distinct lobes on the harpagones.

Panorpa davidi Navas

Figure 57

Panorpa davidi Navas, 1908, Mem. Real. Acad. Cienc. Barc., 1908: 415, figs. 19a, b. Esben-Petersen, 1921, Coll. Zool. Selys Long., **5**(2):29, figs. 21-23. Carpenter, 1945, Psyche, **52**(1-2):73, pl. 10, fig. 4.

Body mostly black; vertex black, with a reddish-brown spot behind, touching the eyes; rostrum reddish brown; thorax black,

with a longitudinal median reddish streak; 1st to 6th abdominal segments of male blackish dorsally and ventrally, last few abdominal segments testaceous; the 6th segment with a small, pale, hairy notch on the dorsal tip; no true anal horn present; 7th and 8th abdominal segments much narrower than 6th and of equal length. Fore wing: length, 13 mm.; membrane hyaline, with a feeble yellowish tinge; veins brownish, the greater part of crossveins in the apical half of the wing pale; pterostigmal band complete, with only basal branch; basal band indicated by two spots; apical band rather large, with a separated spot near the hind margin of the wing; both basal and marginal spots absent; pterostigma rather prominent. Hind wing: length 11.5 mm.; similar to fore wing, except that the separated spots of the apical bands are located near the pterostigma. Male genitalia: genital bulb slender; coxopodites long, U-shaped, at the inner distal end of coxopodites giving rise to a prominent papilla, along the inner surface of which there is a row of stout hairs; harpagones small, the outer margin not concave at the middle, the inner margin no true lobe; hypandrium inconspicuous; hypovalvae slender, not reaching to the base of the harpagones; parameres slender and long, the inner surface bearing a series of short barbs.

Female unknown.

Holotype (♂): Mou-pin, Sikang, 1870 (David); in Muséum National d'Histoire Naturelle, Paris.

Distribution: same as holotype.

This species, which has no anal horn in the male, differs from the others of the *davidi* group by its elliptical genital bulb, with long and slender parameres. I have not seen this species. The drawing of the genital bulb (fig. 57) is based upon Carpenter's drawing which he made at the Muséum National in Paris in 1938. The wing markings resemble *Panorpa eheni* n. sp. However, the structure of the genital bulb is quite different from that of the latter.

Panorpa stigmalis Navas

Figures 30, 33

Panorpa stigmalis Navas, 1908, Mem. Real. Acad. Ciene. Barc., 1908: 406, fig. 20. Esben-Petersen, 1921, Coll. Zool. Selys Long., 5(2):31, figs. 27-30.

Body mostly black; vertex brown, with a blackish spot enclosing the ocelli; rostrum blackish at the apex; thorax black on the dorsum and sides; 2nd and 3rd abdominal segments black above, 2nd segment also black on the venter, the other abdominal segments brownish red; median process of the third tergite rather long, extending posteriorly and in contact with the conical projection on the caudal portion of the fourth tergite; the hind border of the 6th segment furnished with a group of short hairs dorsally and ventrally. Fore wing: length, 17 mm.; very narrow; membrane with a strong yellowish tinge, markings smoky brown; pterostigmal band absent; basal band represented by a narrow streak, extending from the place where 1A joins the hind margin to Cu_1; apical band broad; both basal and marginal spots absent; pterostigma prominent, red in color. Hind wing: length, 16 mm.; similar to the fore, except that the interrupted basal band is entirely absent. Male genitalia: genital bulb oval; coxopodites not very long; harpagones long and slender, the outer margin concave near the middle, inner margin with a basal process; hypandrium very slender, conspicuous; hypovalvae slender, with rather pointed tips, not reaching to the base of the harpagones; preëpiproct slender, with a deep U-shaped distal incision.

Female unknown.

Type (♂): Mou-pin, Sikang (David); in Muséum National d'Histoire Naturelle, Paris.

Distribution: same as type.

This species, belonging to the *davidi* group, is close to the *kongosana* group, as established by Issiki (this group comprises two known species, both of which are continental, i.e., Korean). However, the wing markings are quite different from those of the latter group. I have not seen this species. The drawings of the genital bulb and of the preëpiproct are based on Esben-Petersen's, which he made at the Muséum National in Paris. Unfortunately, his drawings of the male type show nothing of the structure of the parameres and that of the aedeagus.

Panorpa waongkehzengi Navas

Figures 43, 47, 48, 72, 73, 277

Panorpa waongkehzengi Navas, 1935, Notes d'Ent. Chin. Mus. Heude, **2**(5): 98, fig. 62.

Body mostly shining reddish yellow; vertex with a black spot between ocelli; antennae blackish brown; thorax and abdomen slightly darker dorsally. Fore wing: length, 8.3-9 mm.; width, 2.5 mm., with rounded wing apex; membrane yellowish, markings deep brown; pterostigmal band complete, with broad basal branch and a separated apical branch; basal band interrupted, represented by two prominent spots; apical band also interrupted, consisting of two anterior spots and a narrow shadow along the wing apex; basal spot absent; marginal spot prominent; pterostigma prominent, deep yellow. Hind wing: length, 7.7-8.3 mm.; width, 2.4 mm.; similar to fore wing, except that the basal band is represented by only one posterior spot. Male genitalia: genital bulb slender; coxopodites long, with narrow and truncated apex; harpagones very short, the outer margin slightly concave at the middle, inner margin swollen medially with a large cylindrical basal lobe which is concave apically to form the shape of an ear; hypandrium short, broader distally; hypovalvae narrowed towards their rounded apex, not extending near the base of the harpagones; parameres simple, each consisting of a single stalk, which is distinctly twisted and bears a row of short barbs along its inner margin; preëpiproct broad basally, abruptly narrowed towards its apex, which is slightly emarginated and bears a row of long black bristles; aedeagus large, apical processes very long with enlarged boot-shaped apex; lateral processes not prominent, slightly protruding to form a pair of triangular plates. Female genitalia: subgenital plate broad, narrowed towards apex which is slightly concave; internal skeleton large, the plate narrow basally; the posterior arms of the plate stout, pointed, the axis long, strongly sclerotized, extending beyond the plate for exactly half its length.

Types (♂, ♀): Kuling, Kiangsi, Aug. 28, 1935 (Piel); in Heude Museum, Shanghai.

Distribution: same as types.

This species, belonging to the *davidi* group, differs from other described *Panorpa* by its short harpagones and broad hypandrium of the ♂ genitalia. The peculiar structure of the internal skeleton of ♀ genitalia also makes its recognition easy. The description and drawings of both the male and the female of this species are based upon specimens labeled as paratypes, which were loaned to me by the Heude Museum, Shanghai.

Panorpa difficilis Carpenter

Figures 42, 46

Panorpa difficilis Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9):269, figs. 4, 6.

Body black; vertex with a narrow transverse black band enclosing ocelli; rostrum light brown; anal horn absent; last few abdominal segments brown. Fore wing: length, 11 mm.; width 3 mm.; membrane hyaline, markings grayish brown; pterostigmal band broad but interrupted, basal band reduced to a small spot at the origin of R_s (in type); apical band much broken; both basal spot and marginal spot absent; crossveins not margined. Hind wing: similar to the fore wing. Male genitalia: genital bulb rounded; coxopodites long; harpagones small, the outer margins slightly concave, apices abruptly curved, no true lobes present; hypandrium rather conspicuous, hypovalvae of moderate width, not reaching to the base of the harpagones; parameres simple, each consisting of a single stalk, broader distally than proximally, and with a cluster of barbs near the tip; the interior cavity of the genital bulb is unusually narrow; preëpiproct slender, with a deep U-shaped distal incision; apical processes of aedeagus very long with greatly enlarged distal end, lateral processes more or less rounded.

Female unknown.

Holotype (♂): Chengtu, Szechwan, 1936 (D. C. Graham); in U. S. National Museum.

Distribution: same as holotype.

This species, belonging to the *davidi* group, resembles *Panorpa curva* Carpenter superficially, but differs in the broader genital bulb and especially in the absence of the prominent papilla at the distal inner margin of the coxopodites.

Panorpa fructa Cheng

Figures 29, 35, 38

Panorpa fructa Cheng, 1949, Psyche, **56**(4):144, figs. 5, 6, 7.

Body mostly sooty black, last few abdominal segments of male reddish brown, vertex black anteriorly, deeply reddish brown posteriorly; rostrum uniformly reddish brown. Fore wing: length, 11.5 mm.; width, 3 mm.; membrane hyaline, markings light brown, ill-defined, fragmentary; pterostigmal band incomplete, with a spot-like basal branch; basal band represented by two spots; apical band appearing as a light suspicion of brown at the apex; basal spot very small; marginal spots large; pterostigma not very prominent. Hind wing: length, unknown; width, 3 mm.; similar to fore wing, except that the basal band and the basal spot are entirely absent. Male genitalia: genital bulb very rounded; coxopodites long, stout, with four spine-like hairs and a series of short hairs in the distal inner portions; harpagones slender, the outer margin rather straight, inner margin with a median angle and a rather large basal concave area; hypandrium inconspicuous; hypovalvae rather short, far from reaching to the base of the harpagones; parameres simple, long and twisted, the distal half well developed, with rounded apex furnished with a short spine-like tip; preëpiproct rather short, broad at the base, narrowed towards apex, with a broad U-shaped distal incision; aedeagus with long apical and lateral processes, the former with rather straight inner margins and double sinuous outer margins.

Female unknown.

Holotype (♂): Wakiakeng (50 miles west of Tachienlu), Sikang, Sept. 9, 1939 (F. Y. Cheng, Io Chou and Tein Ho Hei): in Cheng Collection, Taipeh.

This species belonging to the *davidi* group, resembles *Panorpa difficilis* Carpenter superficially, but differs in the structure of the male genitalia. In *difficilis*, the apical processes of the aedeagus have greatly enlarged distal ends, whereas in this species, the distal ends of the apical processes of the aedeagus are narrow and rather pointed.

Panorpa cladocerca Navas

Figures 41, 51, 68, 74, 284

Panorpa cladocerca Navas, 1935, Notes d'Ent. Chin. Mus. Heude, **2**(5):95, figs. 59, 60.

Vertex shining black anteriorly, chestnut brown posteriorly; rostrum uniformly shining reddish yellow; thorax black dorsally, deep yellow laterally; 1st to 5th abdominal segments of male black dorsally, reddish yellow ventrally, 6th abdominal segment black anteriorly, chestnut brown posteriorly, last few abdominal segments reddish brown; anal horn absent; abdominal segments of female black dorsally, chestnut brown ventrally. Fore wing: length, 12.5-14.5 mm.; width, 3.6 mm.; membrane hyaline, markings sooty brown; pterostigmal band broad, with same broad basal branch, but no apical branch; basal band complete; apical band large, slightly interrupted posteriorly; basal spot absent; marginal spot very small, not extending to the anterior margin of the wing; pterostigma prominent. Hind wing: length, 11.3-12.7 mm.; width, 3.4 mm.; similar to fore wing, except that the small marginal spot is absent. Male genitalia: genital bulb oval; coxopodites short, with truncated apex; harpagones slender, the outer margin slightly convex at the middle, inner margin with a median angle and a true basal lobe; basal concave area very large, same width as the harpagones and occupying two-thirds of the whole length of the latter; hypandrium inconspicuous; hypovalvae long and slender, slightly crooked at the middle, diverging from each other distally, reaching to the base of the harpagones; parameres simple, each consisting of a single stalk, with broad base and inwardly curved apex, the inner margins usually bearing a row of short barbs; preëpiproct slender, with nearly straight sides and a deep U-shaped distal incision; aedeagus prominent, apical processes short with rounded apex, lateral processes very slender, extending upward behind the basal lobe of the harpagones. Female genitalia: subgenital plate slender, slightly constricted at the middle, with wedge-shaped apex; internal skeleton small, the median portion of the plate less sclerotized, with a pair of narrow vertically erected lobes, the posterior arms of the plate rather long, pointed towards apex.

Types (♂, ♀): Kuling, Kiangsi, Sept. 4-7, 1934 (Piel): in

Heude Museum, Shanghai.

Distribution: same as types.

This species, belonging to the *davidi* group, differs from other described *Panorpa* by its unforked pterostigmal band and the complete basal band in the wing markings. The peculiar structure of both the male and the female genitalia also makes its recognition easy. The description and drawings of both the male and the female of this species are based upon specimens labeled as paratypes which were loaned to me by the Heude Museum, Shanghai.

Panorpa trifasciata n. sp.

Figures 40, 49, 50, 64, 65, 283

Body mostly black; vertex sooty brown with black mark enclosing ocelli; rostrum uniformly grayish brown; thorax light brown laterally, sooty brown dorsally; the 1st to 5th abdominal segments of male piceous black dorsally, 6th segment twice as long as preceding segment, uniformly black, last few abdominal segments nearly same length as the 6th, reddish brown in color, the hind border of the third tergite slightly produced; the 1st to 6th abdominal segments of female blackish brown dorsally and ventrally, last few abdominal segments reddish brown. Fore wing: length, ♂, 13.2 mm., ♀, 15 mm.; width, ♂, 3.1 mm., ♀, 3.6 mm.; membrane hyaline, markings sooty brown; pterostigmal band broad, basal branch of the pterostigmal band well developed, as broad as pterostigmal band so as to form a broad transverse band; apical branch of pterostigmal band absent; basal band complete; apical band prominent; both basal and marginal spots absent; pterostigma very prominent. Hind wing: length, ♂, 12 mm., ♀, 13.5 mm.; width, ♂, 3 mm.; ♀, 3.5 mm.; similar to fore wing, except that the basal band is not so developed. Male genitalia: genital bulb oval; coxopodites long and stout with truncated apex and a row of long spine-like bristles on its distal inner margin; harpagones slender, the outer margin slightly smoothly curved, inner margin with a sharp median angle and a basal lobe which does not arise at the same level as the former; hypandrium short; hypovalvae straight, slender, with rounded apex, not extending near to the base of harpagones; parameres

simple, narrowed towards apex, their whole inner margin bearing dense and long blackish brown, spine-like bristles; the median portion of parameres usually covered by the aedeagus in ventral view; preëpiproct broad, abruptly narrow at the apical portion with deep U-shaped distal incision; aedeagus large, the apical processes tooth-like, lateral processes well developed, long, rod-shaped with swollen apex, extended upward and reaching to the median portion of the harpagones. Female genitalia: subgenital plate rather long, narrowed towards apex with folded margins on its basal portion; internal skeleton small, the median portion of the plate swollen to form a pair of thick margins; posterior arms of the plate narrowed towards apex; no axis present.

Holotype (♂): Ta-chu-lan, Shaowu Hsien, Fukien, Nov. 7, 1943 (Maa); in Museum of National Foochow University, Foochow. Allotype (♀): Sien-feng-ling, Shaowu Hsien, Fukien, Oct. 15, 1941 (Maa); in Maa Collection. Paratypes: 4 ♀♀, same collecting data as holotype; 2 ♂♂, 1 ♀, Kuatun, Chungan Hsien, Fukien, Aug. 22-Oct. 29, 1942-1945 (Maa and Lin), in Maa Collection; 1 ♂, 1 ♀, same collecting data as holotype, in Museum of Comparative Zoology; 2 ♂♂, 3 ♀♀, same collecting data, in Cheng Collection, Taipeh.

This species belongs to the *davidi* group and resembles *Panorpa cladocerca* Navas in the wing markings. However, in *cladocerca,* the wing has more extensive markings and the marginal spot is always present, whereas in *trifasciata,* the three bands of the wing are much narrower than those of *cladocerca* and the marginal spot is absent. The genitalia of *trifasciata* differ from those of *cladocerca* by the peculiar basal lobes of the harpagones of the male and the triangular-shaped subgenital plate of the female.

Panorpa flavicorporis n. sp.

Figures 59, 60, 69, 75, 80

Body yellowish brown; vertex deep brown with slightly blackish-brown mark enclosing ocelli; rostrum uniformly light brown; thorax slightly blackish-brown dorsally, meso- and metanotum with a very broad, light brown streak; the 1st to 5th abdominal

segments of male slightly blackish brown dorsally, last few abdominal segments yellowish brown; the 1st to 6th abdominal segments of female blackish brown dorsally, last few segments yellowish brown. Fore wing: length, ♂, 12.3 mm., ♀, 14.2 mm.; width, ♂, 3.1 mm., ♀, 3.5 mm.; membrane hyaline, markings sooty brown; pterostigmal band complete with narrow basal branch, apical branch not developed; basal band much restricted medially, separated into two spots; apical band large, interrupted posteriorly; basal spot very small; marginal spot prominent; pterostigma not very prominent. Hind wing: length, ♂, 11 mm., ♀, 12.5 mm.; width, ♂, 3.1 mm., ♀, 3.5 mm.; similar to fore wing, except that the basal band is represented only by one spot and both basal and marginal spots are entirely lacking. Male genitalia: genital bulb slender; coxopodites long, with truncated apex; harpagones slender, the outer margin smoothly curved, inner margin with a median angle and a broad basal lobe; hypandrium short; hypovalvae with narrow, blunt apex, reaching far beyond to the base of the harpagones; parameres simple, very long with broad base and twisted apical portion, extending nearly to the apex of harpagones; preëpiproct broad, narrowed towards apex with broad U-shaped distal incision; aedeagus large, the apical processes horn-like, extending outward, lateral processes appearing as a pair of lobes. Female genitalia: subgenital plate long and slender, with folded, narrow, membranous margins and wedge-shaped distal end; internal skeleton very small, the plate rather broad, the posterior arms of the plate narrowed towards apex, the axis small, slightly projecting beyond the plate.

Holotype (♂): Ta-chu-lan, Shaowu Hsien, Fukien, Oct. 21, 1943 (Maa); in Museum of National Foochow University, Foochow. Allotype (♀): Hwang-keng, Kienyang Hsien, Fukien, Oct. 11, 1943 (Maa); in Maa Collection. Paratypes: 8 ♂ ♂, 16 ♀ ♀, same collecting data as holotype; 1 ♂, 2 ♀ ♀, Kienyang Hsien, Fukien, Oct. 17-31, 1942 (Maa), in Maa Collection; 2 ♂ ♂, 2 ♀ ♀, Riu-tun, Kienyang Hsien, Fukien, Oct. 15, 1941 (Maa and Lin), in Museum of Comparative Zoology; 2 ♂ ♂, 4 ♀ ♀, same collecting data, in Cheng Collection, Taipeh.

This species, belonging to the *davidi* group, resembles *Panorpa davidi* Navas in the wing markings. However, in this species,

the marginal spot of the wing is prominent, whereas that of *davidi* is absent. The harpagones of the male genitalia of this species have broad basal lobes, whereas those of *davidi* are absent. The yellowish body color and the peculiar structure of the female genitalia also make its recognition easy.

Panorpa cheni n. sp.

Figures 56, 86, 88, 95, 96

Body brown; vertex blackish brown, with small black mark enclosing ocelli; rostrum uniformly light brown; thorax blackish brown dorsally, light brown laterally; the 1st to 5th abdominal segments of male blackish brown dorsally, light brown ventrally. 6th segment long, cylindrical, blackish brown, last few segments light brown, the hind border of the third tergite slightly produced; 1st to 6th abdominal segments of female black dorsally and ventrally, last few segments light brown. Fore wing: length, ♂, 11.7 mm., ♀, 13.5 mm.; width, ♂, 2.9 mm., ♀, 3.5 mm.; membrane hyaline, markings sooty brown; pterostigmal band complete, basal branch of pterostigmal band broad, the outer margin of the latter with hyaline area, apical branch absent; basal band represented by two narrow spots; apical band present; basal spot absent; marginal spot very small and sometimes absent; pterostigma not very prominent. Hind wing: length, ♂, 10.7 mm., ♀, 12.5 mm.; width, ♂, 2.8 mm., ♀, 3.5 mm.; similar to fore wing, except that the basal band is entirely lacking. Male genitalia: genital bulb oval; coxopodites long, with truncated apex; harpagones slender, the outer margin slightly concave at the middle, inner margin with a prominent tooth-like process and a large true basal lobe which does not arise at the same level; hypandrium inconspicuous; hypovalvae narrow and slender, divergent, not extending near the base of the harpagones; parameres branched basally, the outer branch long, broadened towards apex, with knob-shaped distal end; the inner branch short, with a bundle of long, stiff brown hairs; preëpiproct broad, slightly narrowed towards apex, with U-shaped distal incision; aedeagus with prominent ventral processes and twisted rod-shaped apical processes, lateral processes absent. Female genitalia: subgenital plate triangular, with slightly emarginated

apex; internal skeleton small, the median part of the plate a little swollen, less sclerotized with a very short axis, the posterior arms of the plate long and slender, narrowed towards the apex.

Holotype (♂): Tien-mu-shan, Chekiang, July 27, 1936; in Museum of Institute of Zoology, Academia Sinica, Shanghai. Allotype (♀): Tien-mu-shan, Chekiang, Aug. 17, 1935; same type location as holotype. Paratypes: 1♀, same collecting data and same type location as allotype; 1♀, same collecting data, in Museum of Comparative Zoology; 1♂, 1♀, same collecting data, in Cheng Collection, Taipeh.

I take the liberty to name this species in honor of Dr. Sieien H. Chen who has been so kind as to loan me the material from the Museum of the Institute of Zoology, Academia Sinica, Shanghai.

This species, belonging to the *davidi* group, resembles *Panorpa davidi* Navas and *P. flavicorporis* n. sp. in the wing markings, but is quite different in both the male and the female genitalia. The parameres of the male genitalia of both *davidi* and *flavicorporis* are simple, whereas those of *cheni* are branched. The subgenital plate of the female genitalia of *flavicorporis* is long and slender, whereas that of *cheni* is triangular.

Panorpa obliqua Carpenter

Figures 44, 45, 97, 98

Panorpa obliqua Carpenter, 1945, Psyche, **52**(1-2):70, pl. 10, figs. 2, 3, 8; pl. 11, fig. 9.

Body brown; vertex dark brown; thoracic nota and abdominal tergites very dark brown; anal horn of male absent. Fore wing: length, 12 mm.; width, 3.5 mm.; membrane faintly yellow, markings blackish brown; pterostigmal band complete with rather narrow basal branch and a separated apical branch, the latter connected with the apical band to form a hyaline window which encloses a faint, brown spot; basal band represented by two spots, the large one, situated on the anal margin of wing, is very large with a hyaline window; apical band large, usually united with the apical branch of pterostigmal band, and within its area, there are two hyaline bands and one large hyaline window; basal spot appears as a transverse band along the

anal margin of the wing; marginal spot elongated, band-like, united with the basal branch of pterostigmal band to form a V-shaped marking; pterostigma prominent; crossveins not marginated. Hind wing: similar to fore wing in markings, except that the left "arm" of the "V" is usually interrupted. Male genitalia: genital bulb rounded, coxopodites long, U-shaped; harpagones short, outer margins slightly concave; prominent lobes on inner margin of the harpagones near the base; hypandrium rather long, conspicuous; hypovalvae short, close to each other at the middle of the genital bulb, and extending slightly beyond the base of the harpagones; parameres simple, each consisting of a slightly flattened process, with a few short barbs on the inner surface distally, and terminating in a longer series of barbs directed inwards; preëpiproct much narrower distally, with a pair of broad terminal lobes, close together. Female genitalia: subgenital plate with rounded posterior margin; internal skeleton large, with two long, slender distal processes and a pair of large, ear-like flaps laterally; the usual axis is short, but there is a very slender median process extending posteriorly.

Holotype (♂): Hong San, Southeast Kiangsi, June 28, 1936; in Museum of Comparative Zoology. Allotype (♀): Hong San, Southeast Kiangsi, June 29, 1936; in Museum of Comparative Zoology.

Distribution: same as types.

This strikingly marked species, belonging to the *davidi* group, is easily recognized by the oblique stripe traversing the middle of the wing, and extending posteriorly and distally from the anterior margin. The short hypovalvae of the male genital bulb are unique among the known Chinese species of *Panorpa,* but are very much like those of certain Japanese, Siberian and Formosan species (e.g., *Panorpa preyeri* McLachlan, *wormaldi* McLachlan, and *peterseana* Issiki), to which *obliqua* Carpenter is undoubtedly closely related.

Panorpa implicata n. sp.

Figures 99, 103, 280

Body mostly black; vertex entirely black; rostrum rather short, uniformly reddish brown; thorax pale-white laterally,

sooty brown dorsally; the 1st to 9th abdominal segments of female deep brown dorsally and ventrally. Fore wing: length, 13.5 mm.; width, 3.2 mm.; membrane hyaline, markings sooty brown, similar to the preceding species; pterostigmal band complete with broad basal branch and a separate large apical branch, the latter with a hyaline spot and connected with the apical band to form another hyaline spot; basal band represented by two spots; the one situated on the anal margin of wing is very large and includes a hyaline spot; apical band large, usually united with the apical branch of pterostigmal band, and within its area there are one large hyaline spot and two hyaline bands; basal spot appears as a transverse band along the anal margin of wing; marginal spot elongate, band-like, united with the basal branch of pterostigmal band to form a V-shaped marking; pterostigma prominent. Hind wing: length, 12 mm.; width, 3.1 mm.; similar to the fore. Female genitalia: subgenital plate broadened medially with slightly concave apex; internal skeleton large, the plate bearing paired, folded, side plates; the posterior arms of the plate crooked, narrowed towards apex, the axis long, extending beyond the plate for exactly half its length.

Male unknown.

Holotype (♀): Ta-chu-lan, Shaowu Hsien, Fukien, May 15, 1945 (Maa); in Museum of National Foochow University, Foochow. Paratypes: 2 ♀ ♀, same collecting data as holotype; 1 ♀, Tsi-li-chiao, Chungan Hsien, Fukien, May 1, 1943 (Maa), in Maa Collection; 1 ♀, same collecting data as holotype, in Museum of Comparative Zoology; 1 ♀, Kuatun, Chungan Hsien, Fukien, May 11, 1942 (Maa), in Cheng Collection, Taipeh.

This species resembles *Panorpa obliqua* Carpenter in the wing markings, but differs in the female genitalia. The subgenital plate of *obliqua* has a rounded posterior margin, whereas that of *implicata* is slightly concave. The axis of the internal skeleton of *obliqua* is short, whereas that of *implicata* is long. The position of this species in the above grouping is not determined.

Panorpa baohwashana n. sp.

Figures 82, 83, 84, 101, 105, 285

Body mostly black; vertex uniformly deep black; rostrum uni-

formly brownish black; thorax mostly black dorsally, reddish brown laterally; the 1st to 9th abdominal segments of both sexes black dorsally and ventrally, the hind border of the third tergite of male produced into a short process, and in contact with the small, very sharp conical projection on the median fourth tergite, the 6th to 8th segments prolonged, usually longer than the 5th segment. Fore wing: length, 18-20 mm.; width, 5 mm.; membrane hyaline, markings brownish black; pterostigmal band complete, with broad basal branch and very narrow and separated apical branch; basal band represented by two spots; apical band very large; basal spot absent; between the basal area and the basal band, there are two additional small spots; marginal spot small, not extending to the anterior margin of wing; pterostigma not very prominent. Hind wing: length, 16.5-18.5 mm.; width, 4.5 mm.; similar to fore wing, except that the basal band is represented by only one spot, the two additional spots between the basal area and the basal band are entirely absent, and the marginal spot not well developed. Male genitalia: genital bulb slender; coxopodites long, with truncated apex; harpagones very slender, outer margin deeply concave basally, smoothly curved distally, inner margin with three small lobes; the outer margin folded upward, the apex folded inward to form a rounded distal end which reaches to the base of the harpagones; parameres simple, each consisting of a single stalk, which is broader distally than basally and bears on its distal inner margin a row of short barbs; preëpiproct slender, the basal portion broad, oval; the distal portion narrow, the apex with very minute distal incision usually folded downward; aedeagus with prominent ventral processes, apical processes long with folded apical portion, extending above the basal lobes of harpagones, lateral processes finger-like, extending upward. Female genitalia: subgenital plate broader distally than basally, with small V-shaped distal incision, the median longitudinal line of the subgenital plate less sclerotized; internal skeleton with long and stout axis, the plate long and narrow, occupying the area between the two axes, the posterior arms of the plate well-developed, with sharp apex.

Holotype (♂): Bao-hwa-shan, Kiangsu, July 16, 1942; in Museum of Institute of Zoology, Academia Sinica, Shanghai. Allotype (♀): Same collecting data and same type location as

holotype. Paratypes: 4 ♂ ♂, 5 ♀ ♀, same collecting data as holotype, in same type location as holotype; 2 ♂ ♂, 2 ♀ ♀, same collecting data as holotype, in Museum of Comparative Zoology; 2 ♂ ♂, 3 ♀ ♀, same collecting data; 3 ♂ ♂, 2 ♀ ♀, N. Han-nu-shan, July 16, 1940, in Cheng Collection, Taipeh.

This species, belonging to the *davidi group,* resembles *Panorpa approximata* Esben-Petersen, which is in the *amurensis* group, as established by Issiki (this group comprises four known species, all of which are known as continental, i.e., E. Siberia and Korea), but differs in several respects. Esben-Petersen's drawing of the male genitalia of *approximata* shows that the hypandrium is rather long and the distal end of the preëpiproct is only slightly emarginated. The distal part of the hypandrium of this new species is deeply cleft to form the narrow bases of the hypovalvae; the distal end of the preëpiproct has a narrow U-shaped distal incision. Unfortunately, according to Esben-Petersen, the type of *approximata* (♂) lacks the parameres, so I cannot compare the genital structures of these two species in detail.

Panorpa typicoides Cheng

Figures 26, 36, 39, 66, 67, 276

Panorpa typicoides Cheng, 1949, Psyche, **56**(4): 143, figs. 3, 13, 14, 28, 31.

Body mostly black; vertex black anteriorly, brown posteriorly; rostrum entirely brown; thorax black dorsally, yellowish brown laterally, meso- and metanotum with a broad brown median band; 1st to 6th abdominal segments of male black dorsally and ventrally, last few abdominal segments reddish brown, anal horn absent; the hind border of third tergite slightly prolonged behind, and in contact with the small, sharp conical production on the median axis of the 4th tergite; abdominal segments of female entirely black. Fore wing: length, 12.5 mm.; width, 3 mm.; membrane hyaline, markings sooty brown; pterostigmal band complete, with a broad basal branch and a separated narrow apical branch; basal band interrupted, represented by two large spots; apical band broad, with a large hyaline spot posteriorly; basal spot very small; marginal spot large, not extending beyond the vein R_1; pterostigma brown, very prominent. Hind wing: length, 11.5 mm.; width, 3.3 mm.; similar to fore wing, except that the basal spot and the anterior part of the basal band are

entirely lacking. Male genitalia: genital bulb rounded; coxopodites long, U-shaped, furnished with a series of long hairs at the distal inner portion; harpagones slender, the outer margin slightly concave at the middle, inner margin with a median angle and a small basal concave area; hypandrium inconspicuous; hypovalvae rather long, reaching to the base of the harpagones; parameres simple and slender, each consisting of a single stalk, which is distinctly twisted and pointed at its apex; preëpiproct slender, slightly narrowed towards apex, with a deep U-shaped distal incision; aedeagus with finger-shaped apical processes and slightly prolonged lateral processes, the distal inner margins of the former usually produced inwards to form a small nipple-shaped plate. Female genitalia: subgenital plate elongated, broadened at the middle; internal skeleton long, the plate narrowed towards its base with a pair of sharp posterior arms, the axis very long, extending nearly two-thirds its length beyond the plate.

Holotype (♀): Tachienlu (5000-8500 ft.), Sikang, Aug. 27, 1939 (F. Y. Cheng, Io Chou and Tein Ho Hei); in Museum of Comparative Zoology. Allotype (♀): same collecting data as holotype; in Cheng Collection, Taipeh.

Distribution: same as types.

This species, belonging to the *davidi* group, resembles the common European species *Panorpa communis* Linné and *P. fukiensis* Tjeder in the wing markings, but differs in the structure of the male genitalia. The parameres of *communis* are very broad, lobe-shaped; those of *fukiensis* are spindle-shaped, whereas those of *typicoides* are narrow and slender, thread-like.

Panorpa fukiensis Tjeder

Figures 54, 58, 70, 71

Panorpa fukiensis Tjeder, 1950, Bonn Zool. Beitr., 1950 (2-4):286, figs. 1, 2.

Head blackish brown; rostrum yellowish brown; thorax blackish brown dorsally, yellowish brown laterally, the meso- and metanotum with light brown across their hind parts; 1st to 5th abdominal segments of male blackish brown dorsally; 6th segment blackish brown in the upper part and faintly yellow in the lower part, no anal horn present; 7th and 8th segments long and narrow, of the same length; abdomen of female long and slender,

blackish brown, a little lighter at the basal portion; apex of the abdomen light brown; additional side plates of the 7th and 8th segments very narrow, 9th tergite long. Fore wing: length, ♂, 14 mm.; ♀, 16 mm.; width, ♂, 3.3 mm.; ♀, 3.8 mm.; membrane hyaline, markings blackish brown; veins whitish; pterostigmal band distinct, with broad basal branch and separated narrower apical branch; basal band broad, complete; apical band broad, interrupted posteriorly, connected with the pterostigmal band anteriorly; basal spot absent; marginal spot present; pterostigma rather prominent. Hind wing: length, ♂, 12.5 mm.; ♀, 14 mm.; width, ♂, 3 mm.; ♀, 3.5 mm.; similar to fore wing. Male genitalia: genital bulb elliptical; coxopodites long, with more or less truncated apex; harpagones slender, the outer margin smoothly curved, inner margin with broad tooth-like projection, the median tooth located ventrally; hypandrium narrow, conspicuous; hypovalvae short, reaching about the middle of the coxopodites, slightly diverging from each other; parameres simple, spindle-shaped distally, each with eleven long, strong barbs on its inner edge and the same number of slightly narrower barbs at its apex; preëpiproct narrow, with almost parallel edges and a deep U-shaped distal incision; aedeagus with long finger-like apical processes and ax-shaped lateral processes. Female genitalia: subgenital plate long, narrowed towards apex; internal skeleton large, the outer margins slightly concave at the middle, with a pair of sharp posterior arms; axis well-developed, outwardly curved at their proximal ends, extending beyond the plate for about one-third its length.

Holotype (♂): Kwangtseh, Fukien, Sept. 25, 1937 (J. Klapperich); in Zool. Reichsinstitut and Museum A. Koenig. Allotype (♀): Kwangtseh, Fukien, Oct. 9, 1937 (J. Klapperich); same type location as holotype.

Distribution: same as types.

This species, belonging to the *davidi* group, resembles *Panorpa typicoides* Cheng in the wing markings, but the shape of the genital segments of both the male and the female make it a distinct species.

Panorpa curva Carpenter

Figures 52, 53

Panorpa curva Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9):269, figs. 1, 8.

Body black; vertex with a transverse black band, enclosing the ocelli; rostrum light reddish brown; anal horn absent; last few abdominal segments reddish brown. Fore wing: length, 7 mm.; width, 3 mm.; membrane hyaline, markings grayish brown; both basal and marginal spots absent; basal, pterostigmal and apical bands complete, the last with a few interrupted spots; crossveins not margined. Hind wing: similar to the fore wing. Male genitalia: genital bulb rather long; coxopodites very long, deep U-shaped; at the inner distal margins of coxopodites, there is a very prominent papilla bearing a number of black hairs and giving rise proximally to a large black spine; harpagones small, the outer margins slightly concave near the middle, the apices abruptly curved; no true lobes present; hypandrium inconspicuous; hypovalvae rather slender, not reaching to the base of the harpagones; parameres simple, each consisting of a single stalk, which is distinctly twisted and bears distally a cluster of short barbs; preëpiproct slender, with nearly straight side and a deep U-shaped distal incision; apical processes of aedeagus very long and slender, the outer margins abruptly convex near the middle, the lateral processes short, horn-like.

Female unknown.

Holotype (♂): 0-er (9000 ft., 26 miles north of Li-fan), Sikang, Aug. 6, 1916 (D. C. Graham); in U. S. National Museum.

This species, belonging to the *davidi* group, resembles *Panorpa davidi* Navas superficially. However, the parameres of this species are distinctly twisted distally, whereas those of *davidi* are not so. The outer margins of the harpagones of *curva* are slightly concave at the middle, whereas those of *davidi* are not concave at all.

Panorpa aurea n. sp.

Figures 55, 61, 62, 76, 77, 281

Body yellowish brown; vertex brown anteriorly with sooty brown mark enclosing ocelli, yellowish brown posteriorly with

three narrow longitudinal streaks; rostrum uniformly yellow; thorax yellow laterally, meso- and metanotum deep brown anteriorly, yellowish brown posteriorly; the 1st to 5th abdominal segments of male and female brown dorsally, last few abdominal segments yellowish brown, the hind border of the third abdominal tergite of male slightly produced. Fore wing: length, ♂, 15.5 mm., ♀, 16.3 mm.; width, ♂, 4 mm., ♀, 4.2 mm.; membrane light yellow, markings yellowish brown; pterostigmal band complete with same broad basal branch and apical branch; basal band broad, complete; apical band large, with a faint and small window; both basal and marginal spots are very small; pterostigma not prominent. Hind wing: length, ♂, 14.5 mm., ♀, 14.7 mm.; width, ♂, 3.7 mm., ♀, 4 mm.; similar to fore wing except that both basal and marginal spots are entirely lacking. Male genitalia: genital bulb slender; coxopodites long with truncated apex; harpagones slender, the outer margin slightly concave basally, smoothly curved distally, inner margin with a median small angle and a long and large basal concave area; hypandrium short; hypovalvae slender with rounded apex, not extending near the base of the harpagones; parameres long, Y-shaped, the outer branch crooked, the inner branch straight; preëpiproct long with deep U-shaped distal incision; aedeagus elongated, the apical processes long and sharp, lateral processes short, lobe-shaped. Female genitalia: subgenital plate long with wedge-shaped distal end; internal skeleton large, the plate constricted medially to form the proximal and distal oval portions, the posterior arms of the plate narrowed towards apex, the axis long, with broad base, extending beyond the plate for exactly half its length.

Holotype (♂): Kuatun, Chungan Hsien, Fukien, Oct. 28, 1942 (Maa); in Maa Collection. Allotype (♀): Kwantseh Hsien, Fukien, Sept. 23, 1943 (Maa); in Museum of National Foochow University, Foochow. Paratypes: 1 ♀, same collecting data as allotype, in Museum of National Foochow University; 4 ♀ ♀, same collecting data as holotype; 4 ♀ ♀, Ta-chu-lan, Shaowu Hsien, Fukien, Oct. 14-28, 1942 (Maa), in Maa Collection; 1 ♂, 1 ♀, Ta-chi-lan, Shaowu Hsien, Fukien, Sept. 2-Nov. 28, 1942 (Maa), in Museum of Comparative Zoology; 1 ♂, 1 ♀, same collecting data, in Cheng Collection, Taipeh.

This species, belonging to the *davidi* group, differs from other

described *Panorpa* by its golden body color and the peculiar structures of both the male and the female genitalia.

PANORPA COOMANI n. sp.

Figures 63, 79, 282

Body dull brown; vertex deep brown, with black mark enclosing ocelli; rostrum dull brown, on each of its sides a black longitudinal stripe which narrows towards distal end; thorax deep brown dorsally, meso- and metanotum with black marking on each side; the 1st to 3rd abdominal segments of male slightly blackish brown dorsally, the rest of segments reddish brown, 6th to 8th segments much prolonged, the hind border of the 3rd tergite slightly produced. Fore wing: length, 11.3 mm.; width, 3 mm.; membrane hyaline, markings sooty brown; pterostigmal band complete, with broad basal branch and apical branch; basal band interrupted medianly; apical band large, with a large hyaline spot; both basal and marginal spots present; pterostigma prominent. Hind wing: length, 10.5 mm.; width, 2.8 mm.; similar to fore wing, except that the basal spot is not so well developed. Male genitalia: genital bulb elliptical; coxopodites long, with truncated apex; harpagones slender, the outer margin not concave at the middle, inner margin with a median angle and a median toothed lobe; hypandrium very short; hypovalvae narrow and slender, not extending near the base of the harpagones; parameres Y-shaped, the inner branch very narrow, the outer branch broader and longer with a row of short barbs on its distal inner margin; preëpiproct broad basally, narrow distally, with deep V-shaped distal incision; aedeagus elongated, the apical processes long, finger-like, lateral processes short, extended downward, just opposite to the direction of the apical processes.

Female unknown.

Holotype (♂): Ku-ling, Kiangsi, Sept. 18, 1945; in Heude Museum, Shanghai.

I take the liberty to name this species in honor of Father De Cooman, who has been so kind as to loan me the material from the Heude Museum.

This species, belonging to the *davidi* group, differs from other described *Panorpa* by its small body size and the peculiar structure of the male genitalia.

Panorpa japonica Thunberg

Figures 85, 90, 100, 104, 286

Panorpa japonica Thunberg, 1784, Nov. Ins. Sp. Dissert., **3**:67, fig. 9. Burmeister, 1839, Handb. Ent., **2**:957. Westwood, 1846, Trans. Ent. Soc. London, 1846:188. McLachlan, 1868, Journ. Linn. Soc., **9**:256. *Id.*, 1875, Trans. Ent. Soc. London, 1875: 183. Miyake, 1908, Bull. Coll. Agr. Imp. Univ. Tokyo, 1908:1. *Id.*, 1913, Journ. Coll. Agr. Imp. Univ. Tokyo, 1913: 347, pl. 30, fig. 14, pl. 35, figs. 1, 2, 3, 4, 5, 6. Esben Petersen, 1921, Coll. Zool. Selys Long. **5** (2):43, figs. 45, 46.

Panorpa macrogaster McLachlan, 1868, Journ. Linn. Soc., 1868:257. *Id.*, 1875, Trans. Ent. Soc. London, 1875:184.

Panorpa leucothyria Navas, 1908, Mem. Real. Acad. Cienc. Barcelona, 1908:414.

Panorpa dyscola Navas, 1908, Mem. Real. Acad. Cienc. Barcelona, 1908:420.

Panorpa rectifasciata Miyake, 1908, Bull. Coll. Agr. Imp. Univ. Tokyo. 1908:5, pl. 1, figs. 10, 10a, 10b. *Id.*, 1913, Journ. Coll. Agr. Imp. Univ. Tokyo, 1913:350, pl. 30, fig. 16, pl. 35 figs. 7, 8.

Panorpa niphonensis Miyake, 1908, Bull. Coll. Agr. Imp. Univ. Tokyo, 1908:7, pl. 1, figs. 3, 3a, 3b.

Panorpa pulchra Miyake, 1908, Bull. Coll. Agr. Imp. Univ. Tokyo, 1908:8, pl. 1, fig. 4. *Id.*, 1913, Coll. Agr. Imp. Univ. Tokyo, 1913:349, pl. 30, fig. 17, pl. 35, figs. 4, 7, 9.

Panorpa sinanoensis Miyake, 1909, Bull. Coll. Agr. Imp. Univ. Tokyo, 1909:4, pl. 1, figs. 7, 7a, 7b.

Panorpa hageni Navas, 1909, Rev. Russe d'Ent., **9**:276.

Panorpa irregularis Miyake, 1910, Journ. Coll. Agr. Imp. Univ. Tokyo, 1910:198, pl. 11, figs. 7, 7a, 7b.

Panorpa japonica subsp. *macrogaster* Miyake, 1913, Journ. Coll. Agr. Imp. Univ. Tokyo. 1913:348.

Aulops interrupta Navas, 1913, Rev. Russe d'Ent., **13**:283, fig. 11.

Body mostly deeply black, often shining; the hind border of third abdominal tergite of male produced into a short and broad lobe, 6th abdominal segment cylindrical, 7th segment as long as 6th, but thinner, and its posterior angles somewhat produced, forming a triangular tooth; 8th segment much longer than 7th, slightly thickened towards the apex, which is obliquely truncate above; no anal horn present. Fore wing: length, 15-19 mm.; broad, with rounded tips; membrane with slightly yellowish tinge, markings sooty black; pterostigmal band complete, with a very broad basal branch and a very narrow apical branch; in

some specimens, the latter is absent, or present either as a complete, curved streak or as a spot at the hind margin; apical band very broad, the inner margin somewhat concave; in some specimens the pterostigmal band and the apical band may be traversed longitudinally by a pale line between each of the longitudinal veins; in the apical band these pale lines are divided by the darker crossveins; basal band either as a complete, oblique band or as one or two separated spots; basal spot mostly absent, but in some strongly marked specimens, a basal spot, sometimes isolated and sometimes connected with the basal band; marginal spot present mostly, but usually a little separated from the margin; pterostigma not very prominent; veins blackish brown. Hind wing: length, 14-18 mm.; similar to the fore. Male genitalia: genital bulb oval; coxopodites not very long; harpagones long and slender, the outer margin smoothly curved, inner margin more or less uneven; the median tooth is very close to the base of the harpagones, the basal lobe very small and triangular; hypandrium conspicuous, appearing as a long narrow stalk; hypovalvae narrow, short and thick, usually divergent from each other, nearly reaching to the base of the harpagones; parameres simple, short rod-like; preëpiproct tongue-shaped, with rounded apex; aedeagus with a pair of peculiar, weakly sclerotized, hairy, flattened structures and a pair of strongly sclerotized club-shaped processes; lateral processes of the aedeagus not distinct. Female genitalia: subgenital plate rather long, with V-shaped distal incision; internal skeleton small, long U-shaped, the plate not highly sclerotized, with a rounded anterior margin, axis not present.

Type: Japan; in Zool. Mus. Univ. Upsala.

Distribution: Tien-tseun, China; Gifu, Japan, April-May 1886; Yokoama, Japan; Higo, 1906, Japan; Kumamoto, Japan, April 17, 1913.

This species, belonging to the *davidi* group, is very common in Japan. Issiki has established a *japonica* group which included this species, *Panorpa klugi* McLachlan, *P. nipponensis* Navas and *P. obscura* Miyake. Apparently *japonica* resembles in general appearance these three Japanese species. However, the wing membranes of *klugi* and *nipponensis* are strongly yellowish and that of *obscura* is ochraceous yellow, whereas that of *japonica* is

only slightly yellow. The male genitalia of *japonica* also show some differences from those of the other three allied species. It is interesting to note that the aedeagus of the male and the internal skeleton of the female of *japonica* are similar to those of most *Neopanorpa*.

Panorpa tetrazonia Navas

Figures 91, 92, 93, 94

Panorpa tetrazonia Navas, 1935, Notes d'Ent. Chin. Mus. Heude, **2**(5):96, fig. 61. Carpenter, 1945, Psyche, **52**(1-2):71, pl. 10, figs. 1, 5, 6; pl. 11, fig. 10.

Body light to dark brown; vertex black anteriorly, light brown posteriorly; the thoracic nota and abdominal tergites being somewhat darker than the rest of the body; anal horn of male absent. Fore wing: length, 12-13 mm.; width, 3-3.5 mm.; membrane faintly yellow, markings brown; pterostigmal band complete, with broad basal branch and a narrow apical branch; apical band interrupted posteriorly and usually with a few small clear spots around the crossveins; basal band complete but slender; basal spot present; marginal spot elongate; crossveins not margined. Hind wing: similar to the fore, except that the basal band is interrupted and the basal spot is absent. Male genitalia: genital bulb oval; coxopodites long, U-shaped; harpagones moderately long, the outer margin not concave, inner margin with prominent lobe; hypandrium inconspicuous; hypovalvae broad and short, not extending as far as the bases of the harpagones; parameres conspicuous, each arising from a very slender stalk which widens abruptly and gives rise to a long curved process; the wide head of the stalk and the curved process bear numerous long barbs; preëpiproct with a shallow distal concavity; apical processes of aedeagus rather long, with narrower distal ends; lateral processes very short. Female genitalia: subgenital plate slender; internal skeleton with broad plate and short axis, posterior arms slender, slightly convergent distally.

Holotype (♂): Kuling, Kiangsi; in Heude Museum, Shanghai.

Distribution: Kuling, Kiangsi; Taiping-shien, Anhwei, Oct. 1932 (G. Liu); Huang-shan (few miles southwest of Taiping-shien, Anhwei).

This species, belonging to the *davidi* group, differs from all the formerly described *Panorpa* by its genital structures. The parameres of the male are most unusual, as is also the form of the internal skeleton of the genital segment of the female.

Panorpa sexspinosa Cheng

Figures 81, 87, 89, 123, 124, 278

Panorpa sexspinosa Cheng, 1949, Psyche, **56**(4):145, figs. 4, 8, 9, 15, 16.

Vertex yellowish brown, with four black spots on its anterior region, one small spot enclosing the median ocelli anteriorly, one around the other two ocelli posteriorly, the other two are on both sides of the former two spots; rostrum uniformly yellowish brown; thorax blackish brown dorsally, light yellow laterally, meso- and metanotum as a rule with broad median light yellowish streaks; abdominal segments blackish brown dorsally, light brown ventrally, the hind part of 6th abdominal segment of male and its last few abdominal segments yellowish brown, the hind border of the third tergite with a band-like prolongation. Fore wing: length, 12 mm.; width, 3 mm.; membrane hyaline, markings blackish brown; pterostigmal band complete, with a broad basal branch and a narrow apical branch; basal band unusually broad; apical band complete, with a hyaline spot; basal spot very small; pterostigma not very prominent. Hind wing: length, 10.8 mm.; width, 3 mm.; similar to fore wing, except that the basal spot is lacking. Male genitalia: genital bulb rounded; coxopodites long, with six spines on its distal inner margin; harpagones slender, the outer margin smoothly curved, inner margin with a reduced median angle and a large basal concave area; hypandrium inconspicuous; hypovalvae rather short, not nearly reaching to the base of the harpagones; parameres narrow and slender, each consisting of a single stalk which is somewhat twisted and pointed at its tip; preëpiproct slender, the distal incision being almost quadrate; apical processes of aedeagus somewhat prolonged on its distal outer margins, lateral processes well-developed. Female genitalia: subgenital plate elongate, slightly emarginate posteriorly; internal skeleton large, the plate distinctly concave at its base, with a pair of sharp posterior arms and a pair of anterior side plates; axis well-developed, extending beyond the plate for nearly one-third its length.

Holotype (♂): Mt. Taipai, Shensi, June, 1942 (Io Chou); in Cheng Collection, Taipeh. Allotype (♀): same collecting data as holotype; in Museum of Comparative Zoology.

Distribution: same as types.

This species, belonging to the *davidi* group, differs from the formerly described *Panorpa* in its wing markings; the basal band is as broad as in *Panorpa cladocerca* Navas, but its pterostigmal band is quite different. The structure of the male genitalia, especially the six spines on the distal coxopodites, makes its recognition easy.

Panorpa tincta Navas

Figure 78

Panorpa tincta Navas, 1931, Rev. Acad. Ciene. Madrid, **26**:75, fig. 13.

Vertex black; rostrum dull yellow; thorax black; abdomen tawny yellow ventrally, black dorsally with fine dull yellow hairs on the straight posterior border of the tergites; 6th abdominal segment cylindrical, brownish yellow, somewhat narrowed towards apex where it is obliquely cut off dorsally; 7th segment narrow at the base, cylindrical and black in color dorsally, with a sudden swelling near the middle, the upper border of the swollen part being slightly concave, the tip oblique, the lower border convex basally and somewhat concave towards the middle; 8th segment, with narrow cylindrical base, gradually enlarges, the upper border being at first concave and then slightly convex, while the lower border is almost straight. Fore wing: length, 15 mm.; apex elliptically rounded; membrane yellow, markings dark rust colored, indistinct; pterostigmal band complete with connecting basal branch and apical branch; basal band well-developed, extending from the subcostal to the anal margin of the wing and broadened towards the posterior end; apical band complete, sinuous on its inner margin; basal spot absent; marginal spot present; veins black in color; pterostigma rather prominent, dirty yellowish. Hind wing: length, 13.5 mm.: similar to the fore, except that the basal band and the marginal spot are absent. The ♂ genitalia have not been worked out. However, according to Navas' original description, the preëpiproct ("upper cerci" of Navas) is long, slender and bowed;

the hypovalvae ("lower cerci" of Navas), oblong, with rounded tips, are almost in contact with each other and have nearly parallel margins.

Female unknown.

Type (♂): Hweihsien, Kansu; M. H.; in Hamburg Museum.

Distribution: same as type.

This species, having a deep yellow wing membrane, belongs to the *davidi* group. It differs from the other species with yellow wing-membranes by its indistinct wing markings and the well-developed basal band. The shape of the 6-8th abdominal segments also makes its recognition easy. I have not seen this species. The above description is based upon Navas' original description.

Panorpa lutea Carpenter

Figures 107, 112

Panorpa lutea Carpenter, 1945, Psyche, **52**(1-2):72, pl. 10, fig. 7, pl. 11, fig. 11.

Body reddish brown; darker brown on vertex, thoracic nota and abdominal tergites. Fore wing: length, 15 mm.; width, 3.5 mm.; membrane deep yellow or orange, markings blackish brown; pterostigmal band complete, with broad basal branch and broad apical branch; apical band separated by a wide hyaline stripe into a large anterior apical area and a small posterior spot; basal band complete and very broad; basal spot present; marginal spot rectangular; crossveins not margined; Hind wing: similar to fore wing. Female genitalia: subgenital plate broad; internal skeleton small, with a very short axis and convergent posterior processes.

Male unknown.

Holotype (♀): Huang-shan, Anhwei (G. Liu); in Museum of Comparative Zoology.

Distribution: Huang-shan, Anhwei; Kinhua-shan, Anhwei, Oct. 1932.

This species, which is not determined in the above grouping, is unlike any other described *Panorpa* in the deep yellow color of the wings, which have the basal spot present and a complete, forked pterostigmal band.

Panorpa klapperichi Tjeder

Figures 120, 121, 126

Panorpa klapperichi Tjeder, 1950, Bonn Zool. Beitr., 1950 (2-4):289, figs. 3, 4.

Head blackish brown, rostrum light brown; pronotum blackish brown, meso- and metanotum light brown with darker spots at the bases of the fore and hind wing; abdomen blackish brown dorsally, slightly lighter ventrally, the apex of the abdomen yellowish brown; additional side plates of the 7th and 8th segments large; 9th tergite long and broad, its lateral borders bent ventrad to embrace the side borders of the subgenital plate. Fore wing: length, 13 mm.; width, 3.5 mm.; membrane hyaline, markings blackish brown; veins yellowish; pterostigmal band complete, with broad basal branch and narrower apical branch; apical band large, with two or three indistinct small windows; basal band narrow; both basal spot and marginal spot present; pterostigma prominent. Hind wing: length, 11.5 mm.; width, 3.5 mm.; similar to fore wing, except that the basal band is interrupted, represented only as a spot at the hind margin of the wing and the basal spot is entirely absent. Female genitalia: according to Tjeder's drawings, the subgenital plate is long and narrow, concave at the middle, the apex slightly concave; internal skeleton very small, located at the posterior half of the subgenital plate, posterior arms narrowed towards apex, the axis extremely small and obliquely placed, so that their proximal ends point obliquely upward, the proximal ends not extending beyond the plate.

Male unknown.

Holotype (♀): Kwangtseh, Fukien, Oct. 9, 1937 (J. Klapperich); in Museum A. Koenig, Bonn.

This species, which I have not seen, differs from all the formerly described species by the internal skeleton, which is very small in proportion to the subgenital plate and also by the peculiar small axis. The position of this species in the above grouping is not determined.

Panorpa semifasciata Cheng

Figures 113, 114, 122, 274

Panorpa semifasciata Cheng, 1949, Psyche, **56**(4):146, figs. 19, 20, 21, 53.

Body entirely sooty black; vertex black; rostrum uniformly black; the middle part of the 8th abdominal tergite slightly prolonged into a band-like extension, the 9th tergite very broad, its lateral borders bent ventrad to embrace the posterior part of the subgenital plate in ventral view. Fore wing: length, 14 mm.; width, 3.5 mm.; membrane light yellow, markings sooty brown; pterostigmal band incomplete, with an interrupted narrow basal branch; apical band small, with two hyaline spots; pterostigma prominent. Hind wing: length, 12.8 mm.; width, 3 mm.; similar to fore wing, except that the basal branch of pterostigmal band is greatly reduced. Female genitalia: subgenital plate broad, with strongly sclerotized median part and less sclerotized narrow borders, apex of subgenital plate protruded, rounded, less sclerotized, furnished with several long hairs; the sides of the plate are enclosed by the well-developed 9th tergite as mentioned above; internal skeleton flattened, the plate very small, less sclerotized; the posterior arms of the internal skeleton very long, sharp and strongly sclerotized, the anterior arms flattened, joined with the posterior arms and extending a little beyond the plate.

Male unknown.

Holotype (♀): Jihti (30 miles east of Tachienlu), Sikang, Sept. 1, 1939 (F. Y. Cheng, Io Chou and Tein Ho Hei); in Cheng Collection, Taipeh.

This species differs from all the formerly described species by its black body color, reduced wing markings and the peculiar shape of the genital segment of the female. The position of this species in the above grouping is not determined.

Panorpa leei Cheng

Figures 125, 127, 275

Panorpa leei Cheng, 1949, Psyche, **56**(4):147, figs. 17, 18, 54.

Vertex black; rostrum reddish brown, with a short and deep brown stripe on each side of its upper portion; thorax black dorsally, yellowish brown laterally; 1st to 6th abdominal seg-

ments black dorsally and ventrally, the 7th to 9th abdominal segments very small, reddish brown. Fore wing: length, 14 mm.; width, 4 mm.; membrane hyaline, markings sooty brown; pterostigmal band broad, with a complete basal branch and a greatly reduced spot-shaped apical branch; apical band small, including a prominent narrow band and some faintly smoky spots; pterostigma prominent. Hind wing: length, 13 mm.; width, 3.55 mm.; similar to fore wing, except that the basal branch of pterostigmal band is greatly reduced. Female genitalia: subgenital plate small, narrowed posteriorly, apex rounded; internal skeleton long, the plate abruptly narrow at the base, with a pair of sharp posterior arms, the axis extending for nearly half its length beyond the plate.

Male unknown.

Holotype (♀): Mt. Taipai, Shensi, July 14, 1943 (Chuan Lung Lee); in Museum of Comparative Zoology.

This species differs from all the formerly described species by its wing markings and the peculiar shape of the genital segment of the female. The position of this species in the above grouping is not determined.

Panorpa grahamana n. sp.

Figures 108, 115

Body mostly black; vertex black; rostrum brownish black, with an orange median longitudinal stripe; the 9th abdominal tergite very broad, its lateral borders bent ventrad to embrace the margins of the subgenital plate in ventral view. Fore wing: length, 13 mm.; width, 3.3 mm.; membrane hyaline, markings sooty brown; pterostigmal band broad, with a broad basal branch, but no apical branch; basal band interrupted, represented as a large spot, extended to the hind margin of the wing; apical band broad, a little interrupted anteriorly; both basal and marginal spots absent; pterostigma rather prominent. Hind wing: length, 12 mm.; width, 3.2 mm.; similar to fore wing, except that the basal band is entirely absent. Female genitalia: subgenital plate slender, tongue-shaped, with strongly sclerotized median part and less sclerotized narrow lateral plates; apex of subgenital plate rounded, less sclerotized, furnished with some prominent

hairs; the sides of the plate enclosed by the well-developed 9th tergite; internal skeleton flattened, with long posterior arms which are narrowed towards apex, anterior arms of the plate slightly outwardly curved.

Male unknown.

Holotype (♀): Suifu, Szechwan, (D. C. Graham); in Museum of Comparative Zoology.,

This species is named in honor of D. C. Graham. It is close to *Panorpa semifasciata* in the female genitalia, but differs greatly in the wing markings. The apex of the subgenital plate of this species is broadly rounded, whereas that of *semifasciata* is protruded and narrowly rounded. The position of this species in the above grouping is not determined.

PANORPA CARPENTERI n. sp.

Figure 116

Body mostly black; vertex black; rostrum uniformly reddish brown; the 9th abdominal tergite very broad, its lateral borders bent ventrad to embrace the margins of the subgenital plate in ventral view. Fore wing: length, 13.2 mm.; width, 3.2 mm.; membrane hyaline, markings sooty brown; pterostigmal band broad, with a broad basal branch, but no apical branch; basal band represented as a small spot; apical band broad, interrupted posteriorly; both basal spot and marginal spot absent; pterostigma rather prominent. Hind wing: length, 12 mm.; width, 3.2 mm.; similar to fore wing, except that the basal branch of pterostigmal band is narrower than that of the fore wing and the basal band is entirely absent. Female genitalia: subgenital plate slender, tongue-shaped, with strongly sclerotized median part and less sclerotized narrow lateral plates, apex of subgenital plate rounded, less sclerotized, furnished with some prominent hairs; the sides of the plate enclosed by the well-developed 9th tergite; internal skeleton flattened, the plate greatly reduced, with very long and sharp posterior arms and well-developed anterior arms; the latter are folded transversely right at its median portion.

Male unknown.

Holotype (♀): foot of Mt. Wa (6000-7000 ft.), Szechwan, July 27, 1925 (D. C. Graham); in Museum of Comparative Zoology.

This species is named in honor of Professor F. M. Carpenter, who has been so kind to me. It resembles the preceding species in both body color and wing markings, but differs in the color of the rostrum and the anterior arms of the internal skeleton of the female genitalia. The position of this species in the above grouping is not determined.

Panorpa statura Cheng

Figures 109, 110, 279

Panorpa statura Cheng, 1949, Psyche, **56**(4):148, figs. 32, 33, 34, 57.

Vertex blackish brown anteriorly, with a black mark within the ocelli, light brown posteriorly, with a median and a pair of longitudinal bands; rostrum uniformly reddish brown; thorax entirely brown laterally, prothorax blackish brown dorsally, meso- and metanotum uniformly blackish brown; 1st to 4th abdominal segments of female blackish brown dorsally, brown ventrally, last few abdominal segments entirely brown. Fore wing: length, 16.5 mm.; width, 4.55 mm.; membrane deeply yellowish brown, markings deep brown; pterostigmal band complete, with a broad basal branch and a broad apical branch; basal band interrupted; apical band large, with a hyaline spot; basal spot absent; marginal spot very small; pterostigma not very prominent. Hind wing: length, 15 mm.; width, 4.2 mm.; similar to fore wing, except that the small marginal spot is lacking. Female genitalia: subgenital plate elongated, narrowed posteriorly, shallowly emarginated at its apex, its lateral borders bent to form a narrow ridge; internal skeleton long, the plate concave on its median sides with a pair of short tooth-like posterior arms; the axis long, extending beyond the plate for exactly half its length.

Male unknown.

Holotype (♀): Mt. Taipai, Shensi, July 14, 1943 (Chuan Lung Lee); in Cheng Collection, Taipeh.

This species, having a yellowish brown wing membrane, differs from *Panorpa flavipennis* Carpenter by its very long wing and the markings of the apical band. The peculiar shape of the genital segment of the female makes its recognition easy. The position of this species in the above grouping is not determined.

Panorpa pusilla Cheng

Figures 118, 119

Panorpa pusilla Cheng, 1949, Psyche, 56(4):149, figs. 37, 38, 52.

Vertex yellow anteriorly, with a black spot enclosing ocelli, sooty brown posteriorly, with a median quadrangular plate; rostrum uniformly yellow; thorax brownish yellow dorsally, yellow laterally, meso- and metanotum with sooty brown markings on each side; abdominal segments sooty brown dorsally, yellow laterally and ventrally. Fore wing: length, 10.8 mm.; width, 2.8 mm.; membrane light yellow, markings sooty brown; pterostigmal band complete, with a complete basal branch and a separated apical branch; basal band complete; apical band represented by two prominent bands, the inner one narrow, being parallel to the pterostigmal band, the outer one running along the wing apex; basal spot situated on the hind margin of wing; marginal spot very large; pterostigma not very prominent. Hind wing: length, 9.5 mm.; width, 2.8 mm.; similar to fore wing, except that the basal spot on the hind margin of wing is entirely lacking. The venation of both fore and hind wings identical; Sc, as usual, does not extend to the pterostigmal area, R_1 is forked and R_2 is simple, no crossvein between R_1 and R_2. Female genitalia: subgenital plate elliptical, with a slightly distal emargination; the plate of the internal skeleton small, the posterior arms of the plate large, twisted at the middle, the axis short and slender, not extending beyond the plate.

Male unknown.

Holotype (♀): Mt. Taipai, Shensi, June, 1942 (Io Chou); in Museum of Comparative Zoology.

This species, having a light yellowish wing membrane differs from the other described *Panorpa* by its very small body size, wing markings and the peculiar shape of the genital segment of the female. The position of this species in the above grouping is not determined.

Panorpa pieli n. sp.

Figures 111, 117

Body yellowish white; vertex brown, with small grayish brown mark enclosing ocelli; rostrum yellowish white, with brownish

yellow longitudinal stripe on each side; thorax yellowish white. meso- and metanotum with yellowish brown mark on each side; the whole abdomen of female brownish yellow dorsally. Fore wing: broad basally, rounded apically; length, 11 mm.; width 3.2 mm.; membrane yellowish white, markings gray; pterostigmal band complete, with a basal branch and a separated apical branch; basal band represented by two spots; apical band represented by an inner spot and an outer band which is enclosed by the wing apex; basal spot absent; marginal spot elongated; pterostigma not prominent. Hind wing: length. 10 mm.; width, 3.2 mm.; similar to fore wing, except that the basal band is represented by only one spot. The venation of fore and hind wings identical, in both pairs of wings Sc, as usual, not extending to the pterostigmal area; R_1 is forked and R_2 is simple, no crossvein between R_1 and R_2. Female genitalia: subgenital plate broad, with a wide V-shaped distal incision; internal skeleton small, the plate rather broad, with long posterior arms which are pointed towards apex; the axis short and slender, not extending beyond the plate.

Male unknown.

Holotype (♀); Ku-ling, Kiangsi, Aug. 18, 1943 (Piel); in Heude Museum, Shanghai.

The material was collected by Dr. Piel, in honor of whom I name the species.

This species resembles *Panorpa pusilla* Cheng in body size, wing venation and wing markings. It is evident that they are closely allied; but the differences in the structure of the genitalia and in the color of the vertex and rostrum are so conspicuous that there is good reason to distinguish it as a good species. The position of this species in the above grouping is not determined.

Panorpa bonis Cheng

Figures 102, 106

Panorpa bonis Cheng, 1949, Psyche, **56**(4):150.

Panorpa cornigera Tjeder (*nec* McLachlan), 1936, Ark. för Zool. **27A** (33):7, pl. 3, pl. 7, fig. 3.

The body characters of this species agree wholly with the

original description for *Panorpa cornigera* McLachlan according to Tjeder. The wing-photo of this species is exactly the same as that of the ♀ type of *cornigera* (given by Esben-Petersen) as Esben-Petersen agreed. The detail drawings of ♀ genitalia were given by Tjeder. According to these drawings, the subgenital plate is oval with smoothly rounded side-margins, which slightly overlap the lower margins of the 9th tergite and its apex is very shallowly emarginated; the internal skeleton large but slender, the two inner pairs of the plate prominent, their proximal part appearing to end straight; posterior arms of the plate with acute distal ends; axis long, extending more than one third its length beyond the plate.

Male unknown.

Holotype (♀): Lu-pa-sze (at river Tao-ho, about 2750 m.) South Kansu, July 11, 1930 (D. Hummel); in Stockholm Museum.

Distribution: same as type.

This species resembles *Panorpa cornigera* McLachlan superficially, but differs in the structure of the female genitalia. The additional lateral plates of the 7th-8th abdominal segments of this species are not so slender as those of *cornigera*. The subgenital plate is pointed at its posterior part and shallowly emarginate at its apex, while that of *cornigera* is rounded and not emarginate. The internal skeleton of this species is quite distinct from that of *cornigera:* the plate of the former is slender with a small proximal part and short posterior arms, while that of the latter is broad, with a well-developed oval proximal part and long pointed posterior arms. The axis of this species extending beyond the plate is less than half the length of the whole axis, while that of *cornigera* usually extends beyond the plate more than half its length. The position of this species in the above grouping is not determined.

Panorpa guttata Navas

Panorpa guttata Navas, 1908, Mem. Real Acad. Cienc. Barcelona, 1908:416, fig. 19c. Esben-Petersen, 1921, Coll. Zool. Selys Long. 5(2):32, fig. 32.

Panorpa davidi (♀) Navas, 1908, Mem. Real Acad. Cienc. Barcelona, 1908: 415, fig. 19c (*nec davidi* Navas, figs. 19a, b).

Head and rostrum grayish testaceous; vertex with a blackish

spot between the ocelli; thorax and abdomen pale castaneous dorsally, pale grayish yellow ventrally. Fore wing: length, 12.5 mm.; membrane hyaline with a faint yellowish tinge; pterostigmal band indicated by a spot posterior to the pterostigma; apical band represented as three faint spots; pterostigma prominent, yellowish; veins brownish. Hind wing: length, 11 mm.; similar to fore wing, except that the faint apical band is absent.

Male unknown.

Type (♀): Mou Pin, Tibet, 1870 (David); in Muséum National d'Histoire Naturelle, Paris.

Distribution: same as type.

This species resembles *Panorpa tjederi* (♀) in the pterostigmal band of the fore wing, but differs in the presence of its apical band. The wings of *tjederi* are subobtuse, whereas those of *guttata* are very narrow and slender. However, a thorough examination of the genitalia of the female type would be highly desirable. The position of this species in the above grouping is not determined.

Genus NEOPANORPA Weele

Neopanorpa Weele, 1909, Notes Leyden Mus. **31**:4. Esben-Petersen, 1913, Notes Leyden Mus. **35**:226. *Id.*, 1921, Coll. Zool. Selys Long. **5**(2):73.
Campodotecnum Enderlein, 1910, Zool. Anz., **35**:391. *Id.*, 1912, Notes Leyden Mus. **34**:235.

Rostrum long and slender; tarsal claws serrated on inner margins; wings are fully developed, rather narrow, especially at the base; 1A short, extending to the anal margin of wing before origin of the radial sector; abdomen in both sexes not longer than the wings; 6th to 8th abdominal segments of male normal, not much prolongated; genital bulb of male not pedunculate basally.

Genotype: *Neopanorpa angustipennis* Westwood.

This genus, common in southeast Asia, includes forty known species in the whole world. Nineteen species have been already recorded in China and eleven new ones are described below, making a total of thirty. They are distributed throughout nine provinces. Since no *Neopanorpa* have been found in North China (Shensi, Kansu) and Korea, I presume therefore that this genus is restricted to North Asia. The limit seems to be approximately along latitude 40°.

The most obvious difference between *Neopanorpa* and *Panorpa* is the length of 1A, as indicated in the key for the family Panorpidae. However, differences are also apparent in the 3rd abdominal tergite and in both male and female genitalia. In the male of *Neopanorpa* the median process of the 3rd abdominal tergite tends to be longer and more slender than that of *Panorpa*. In most of the species of *Neopanorpa,* this process extends to the middle of the 4th tergite or beyond the hind border of the latter (the only exception is *claripennis,* the process of which is not much prolonged and appears as a semicircular lobe). In most species of *Panorpa,* this process is not distinct, only prolonged into a small semicircular lobe (the only exception is *stigmalis,* the process of which extends to the hind portion of the 4th tergite but not beyond the hind border of the latter). In the male of *Neopanorpa* the hypovalvae are broad, mostly overlapping each other distally, whereas those of *Panorpa* are slender, never overlapping each other distally. The parameres of *Neopanorpa* are mostly absent or reduced to a short slender thread-like rod, sometimes branched, without barbs or hairs, and partly or wholly fused with the aedeagus, whereas those of *Panorpa* are well developed, prominent and mostly with barbs or hairs on their inner margins, absolutely free from the aedeagus. The only exception is *japonica* which has reduced rod-shaped parameres and is close to those of *Neopanorpa.* The aedeagus of male *Neopanorpa* is mostly very small, and the paired apical processes are short, almost united together, whereas those of *Panorpa* are very prominent, the two apical processes being very long and wide apart from each other (except in the *diceras* group, the aedeagus of which has united and short apical processes). The preëpiproct of most male *Neopanorpa* has a rounded distal margin (*heii* etc., fig. 156); in some species it is slightly emarginated (*translucida* n. sp., fig. 223), and in others it has distal processes which are directed inward towards the interior of the bulb (*pilosa,* fig. 192, *taoi,* fig. 159). In *Panorpa,* the preëpiproct has a deep U-shaped distal incision, although in *waongkehzengi* it is slightly emarginate and in *japonica* rounded. This again shows that *japonica* is close to *Neopanorpa.* In the female of *Neopanorpa,* the subgenital plate is deeply emarginate distally (except that of *kwangtsehi* n. sp., which is truncated), whereas that of *Panorpa*

has either a rounded apex or is slightly emarginate; the only exception is in *japonica*, in which the subgenital plate is as deeply emarginate as that of the *Neopanorpa*.

The larva of *Neopanorpa* has very short setae, whereas that of *Panorpa* has much longer setae. The larval head sutures of *Neopanorpa* are usually accompanied by a broadly sclerotized band, while those of *Panorpa* are simple. Moreover, along the posterior margin of the 10th abdominal segment of the larval *Neopanorpa* there are numerous hairs, absent in *Panorpa*.

The characteristics which have been used for the specific identification of *Neopanorpa* are the median process of the 3rd abdominal tergite of the male and the wing markings and both the male and female genitalia. In some species the median process of the 3rd tergite of the male is very short, far from reaching to the middle of the fourth tergite (*claripennis*, fig. 132); in others it is very long, extending far beyond the hind border of the 6th abdominal segment (*choui*, fig. 155). The color of wing membrane is useful. In some species, the wings are hyaline (*nigritis*, fig. 287), in others, they are deep yellow (*caveata* n. sp., fig. 290) and in some others, they are faintly yellow (*cavalerici*). The markings of the wings are different from species to species. In *claripennis*, *taoi*, *pilosa*, *nigritis* and *validipennis*, there are no markings at all. In *apicata* only a shadow of dark appears at the wing apex. In *choui* and *kwangtschi* n. sp., the markings are very indistinct, while in some others they are sooty brown and very extensive (*cantonensis* n. sp., fig. 302).

As in the genus *Panorpa*, both the male and the female genitalia of *Neopanorpa* remain perfectly stable even in the minute details. The general structures of both sexes are just the same as those of *Panorpa*. In the male of *Neopanorpa*, the outer margins of the harpagones are mostly concave at the middle (*caveata* n. sp., etc., fig. 133); in others they are distinctly convex (*taoi*, fig. 157, *pilosa*, fig. 193). The hypandrium is usually long and broad (*caveata* n. sp., etc., fig. 133), but in *nigritis* and *choui*, it is very inconspicuous. The hypovalvae are mostly short and broad, usually tending to overlap each other distally (*claripennis*, etc., fig. 136), but in some species, they are narrow and slender (*nigritis*, fig. 191, *mutabilis* n. sp., fig. 141). The parameres are absent in most of the species (*hcii* etc., fig. 162), in others, they are small and rod-shaped (*claripennis*, etc., fig. 136) and in

some others, they are branched (*pilosa,* etc., fig. 193). In the female of *Neopanorpa*, the subgenital plate is distinctly emarginate distally. This emargination is diversely shaped in different species. In *parva,* etc., it is wide and deep (fig. 184). In *pulchra,* etc., it is slightly concave (fig. 182). In *translucida* n. sp., etc., it is V-shaped (fig. 197). In *banksi,* etc., it is U-shaped (fig. 177), and in *kwangtschi* n. sp., it is exceptionally truncated, without emargination at all (fig. 198). The internal skeleton of the female *Neopanorpa* is usually U-shaped, with the axis absent, but in *carcata* n. sp. *nigritis, choui, kwangtschi* n. sp., *translucida* n. sp., *pielina, mutabilis* n. sp. and *maai* n. sp., the axis is prominent and projects beyond the plate of the internal skeleton. The following keys to both male and female *Neopanorpa* are based upon the characteristics mentioned above.

Key to the Males of Neopanorpa

The males of the following species are unknown: *dimidiata* Navas, *banksi* Carpenter, *parva* Carpenter, *pulchra* Carpenter, *latipennis* Cheng, *varia* Cheng, *chaoi* n. sp., *cantonensis* n. sp., *kwangtschi* n. sp., *carpenteri* n. sp.

1. Wing membrane deep yellow 2
   Wing membrane slightly yellow or hyaline 4
2. Apical band large, with four hyaline spots; hypovalvae stout, the inner margins rather straight, the distal portions slightly separated from each other (figs. 133, 290) ..... *caveata* n. sp.
   Apical band smaller, with one or two hyaline spots; hypovalvae overlapping each other distally 3
3. Preëpiproct with a small U-shaped distal incision; the outer margins of the hypovalvae concave at the middle, inner margins straight, each with a proximal lobe (fig. 134) ..... *tienmushana* n. sp.
   Preëpiproct almost truncated; the outer margin of the hypovalvae smoothly curved, inner margins without the proximal lobe (fig. 135) ..... *hyangshana* n. sp.
4. Wings without color markings 5
   Wings with color markings 9
5. Median process of third abdominal tergite very short, not extending to middle of the fourth tergite; preëpiproct with truncated apex ..... *claripennis*
   Median process of third abdominal tergite rather long, usually extending beyond the middle of the fourth tergite; preëpiproct not truncated at the apex 6

6. The outer margins of harpagones convex near the base, basal lobe with two tooth-like processes; preëpiproct with a pair of long distal processes 7
The outer margins of harpagones not convex at all, basal lobe rounded, without a tooth-like process; preëpiproct without the long distal processes 8
7. Parameres simple, leaf-shaped; the outer margins of hypovalvae convex basally (fig. 157) ..... *taoi*
Parameres branched, both branches thread-like; the outer margins of the hypovalvae concave at the middle (fig. 193) ..... *pilosa*
8. Hypandrium short, inconspicuous; hypovalvae slender, less sclerotized and curved inward distally, separating each other, not reaching to the base of the harpagones (fig. 191) ..... *nigritis*
Hypandrium long, conspicuous; hypovalvae broad, overlapping each other, with slender basal stalk, extending far beyond the base of the harpagones (fig. 145) ..... *validipennis*
9. Wing markings represented only by an apical band; no pterostigmal band present ..... *apicata*
Both apical band and pterostigmal band present 10
10. Wing markings indistinct; median process of third abdominal tergite extraordinarily long, measuring up to 4.2 mm., divided into two portions; hypovalvae with an abruptly narrowed apex (figs. 155, 164) ..... *choui*
Wing markings distinct; median process of third abdominal tergite not very long; hypovalvae without abruptly narrow apex 11
11. Wing markings less developed, with a long narrow band and a suspicion of dark on the wing apex; wings with dark longitudinal stripes among their veins and their branches; 7th abdominal segment of male with truncated apex (fig. 188) ..... *brisi*
Wing markings well developed, with broad pterostigmal and apical bands; no longitudinal stripes occur among veins and their branches 12
12. Pterostigmal band with broad basal branch and a separate, narrow apical branch; genital bulb as in figure 162 ..... *heii*
Pterostigmal band with both basal and apical branches, apical branch not separated from the pterostigmal band itself 13
13. Apical band interrupted posteriorly, without hyaline spots 14
Apical band not interrupted posteriorly, with hyaline spots 15
14. Fore wing length measures 14 mm.; median process of the third abdominal segment short, with rounded posterior margin, about half the length of the fourth tergite; genital bulb as in figure 194.. *chelata*
Fore wing length measures 16 mm.; median process of the third abdominal segment narrow and long, almost as long as the fourth tergite ..... *cavaleriei*

15. No additional band occurs between pterostigmal band and apical band 16
A narrow band occurs between pterostigmal and apical band 18
16. Basal band interrupted, represented by two spots which are separated from the marginal spot ..... *lacunaris*
Basal band not interrupted, but irregular, connected with the marginal spot 17
17. Wing markings brown; harpagones with large square-shaped basal lobes; apex of hypovalvae rounded (fig. 148) ..... *translucida* n. sp.
Wing markings sooty brown; harpagones without true lobes; apex of hypovalvae more or less pointed in ventral view (fig. 151) ..... *piclina*
18. Outer margins of hypandrium and hypovalvae slightly concave at the middle; parameres present, consisting of a narrow stalk, which gives rise to two branches (fig. 141) ..... *mutabilis* n. sp.
Outer margins of hypandrium and hypovalvae abruptly concave at the middle; parameres absent 19
19. Hypovalvae slender, with rounded apex as in figure 143 ..... *maai* n. sp.
Hypovalvae broad and stout, with tooth-like apex in ventral view as in figure 149 ..... *ovata* n. sp.

Key to the Females of Neopanorpa

The females of the following species are unknown: *cavaleriei* Navas, *lacunaris* Navas, *brisi* (Navas) Carpenter, *pilosa* Carpenter, *validipennis* Cheng, *taoi* Cheng, *ovata* n. sp.

1. Wing membrane deep yellow 2
Wing membrane slightly yellow or hyaline 4
2. Internal skeleton large, with long and stout axis which extends beyond the plate nearly one-third its length (fig. 204) ..... *caveata* n. sp.
Internal skeleton small, axis absent 3
3. Pterostigmal band with narrow apical branch; basal band interrupted; subgenital plate with deep V-shaped distal incision; internal skeleton as in figure 171 ..... *tienmushana* n. sp.
Pterostigmal band with broad apical branch; basal band complete; subgenital plate with shallow distal incision; internal skeleton as in figure 170 ..... *huangshana* n. sp.
4. Wings without color markings 5
Wings with color markings 6
5. Internal skeleton with long axis as in figure 207 ..... *nigritis*
Internal skeleton without axis as in figure 172 ..... *claripennis*
6. Wing markings represented only by an apical band; no pterostigmal band present ..... *apicata*
Both apical band and pterostigmal band present 7
7. Wing markings indistinct 8
Wing markings distinct 9

8. Pterostigmal band of fore wing complete; subgenital plate with truncated apex; internal skeleton as in figure 202, axis long, with rounded basal ends ..... *kwangtsehi* n. sp.
Pterostigmal band of fore wing incomplete, represented only by a faint basal branch; subgenital plate with a narrow U-shaped distal incision; internal skeleton as in figure 154, axis long, with abruptly curved hook-shaped basal ends ..... *choui*
9. Pterostigmal band with same broad basal branch, but no apical branch; internal skeleton as in figure 181 ..... *banksi*
Pterostigmal band with both basal and apical branches 10
10. Either basal branch or apical branch of pterostigmal band interrupted 11
Both basal branch and apical branch of pterostigmal band complete 14
11. Apical branch of pterostigmal band interrupted, very narrow; basal branch complete 12
Apical branch of pterostigmal band complete; basal branch interrupted 13
12. Wing markings slightly gray; between the pterostigmal band and apical band there is an additional band; internal skeleton as in figure 200, axis straight ..... *maai* n. sp.
Wing markings sooty brown, no additional band between pterostigmal band and apical band; internal skeleton as in figure 212, axis fork-shaped ..... *heii*
13. Apical band interrupted posteriorly; internal skeleton as in figure 214 ..... *varia*
Apical band not interrupted posteriorly, with a faint hyaline spot ..... *dimidiata*
14. Apical band large, complete, without hyaline spot 15
Apical band more or less interrupted or with prominent hyaline spot.. 16
15. Basal spot present; internal skeleton U-shaped as in figure 179 ..... *cantonensis* n. sp.
Basal spot absent; internal skeleton with widely divergent arms as in figure 183 ..... *pulchra*
16. Internal skeleton with long and paired axis 17
Internal skeleton without axis or with single, short axis 19
17. Wing markings brown; subgenital plate with deep V-shaped distal incision; internal skeleton as in figure 201; the length of axis is nearly the same length as the posterior arms ..... *translucida* n. sp.
Wing markings sooty brown; distal incision of the subgenital plate not deep V-shaped; the axis of the internal skeleton longer than the posterior arms 18
18. Wing membrane slightly yellow; rostrum shining reddish brown; subgenital plate with shallow V-shaped distal incision; internal skeleton

as in figure 206 ..... *pielina*

Wing membrane hyaline; rostrum deeply grayish brown; subgenital plate narrow distally, with small U-shaped distal incision; internal skeleton as in figure 205 ..... *mutabilis* n. sp.

19. Wing markings brown; internal skeleton V-shaped as in figure 178 .... *chaoi* n. sp.

Wing markings sooty brown; internal skeleton more or less U-shaped..20

20. Internal skeleton with very short median axis as in figure 185 .... *parva*

Internal skeleton without true axis 21

21. Subgenital plate abruptly narrowed posteriorly, with wide U-shaped distal incision; internal skeleton with a long stalk at its base as in figure 203 ..... *latipennis*

Subgenital plate gradually narrowed posteriorly, with shallow V-shaped distal incision; internal skeleton without long stalk at its base 22

22. Wing length measures up to 16 mm.; wing membrane slightly yellow; apical band with one hyaline spot posteriorly; outer margins of the internal skeleton smooth as in figure 180 ..... *carpenteri* n. sp.

Wing length measures only 14 mm.; wing membrane hyaline; apical band interrupted posteriorly, without hyaline spot; outer margins of the internal skeleton sinuous as in figure 173 ..... *chelata*

Descriptions of Species of Neopanorpa

Neopanorpa caveata n. sp.

Figures 128, 129, 133, 137, 204, 208, 290

Body light brown; vertex brown with a blackish brown mark enclosing ocelli; rostrum uniformly reddish brown; thorax yellowish brown laterally with six black spots, the middle of the meso- and metanotum blackish brown; in addition to mesonotum, there is usually a blackish brown streak along its anterior side margins; the 1st to 5th abdominal segments of male blackish brown dorsally; 6th abdominal segment blackish brown with reddish brown hind margin; last few segments reddish brown, median process of the 3rd tergite short, never extending beyond the hind margin of the 4th tergite and in contact with the conical production on the median axis of the latter; the 1st to 5th abdominal segments of female blackish brown dorsally, last few segments slightly reddish brown. Fore wing: length, 15-16 mm.; width, 3.5 mm. (holotype, length, 15 mm.; width, 3.5 mm.); membrane yellow, markings deep brown; pterostigmal band complete with broad basal branch and apical branch; basal band complete;

apical band large, usually joined to the pterostigmal band by some very narrow additional network-like bands so as to form several hyaline spots; basal spot absent; marginal spot large, band like; pterostigma not very prominent. Hind wing: length, 13-14 mm.; width, 3.4 mm.; similar to fore wing, except that the basal band is represented only by a spot, the network-like additional bands not so developed and the marginal spot entirely lacking. Male genitalia: genital bulb slender; coxopodites long with truncated apex; harpagones slender; the outer margin slightly concave at the middle, inner margin with a slightly protruded median portion and a small true basal lobe; hypandrium very long; hypovalvae stout, the outer margin smoothly curved towards its apex, the inner margin rather straight, the basal parts widely separated and the distal parts slightly separated from each other, the apex of hypovalvae usually reaching to the middle of the harpagones; parameres very short, basal portions bending inward and then upward, the whole paramere fused with the basal part of aedeagus; preëpiproct abruptly narrowed at the distal portion with truncated apex; aedeagus very small, the apical processes united together, lateral processes tooth-like, usually bending upward, the base of aedeagus provided with a pair of sclerotized elongate plates. Female genitalia: subgenital plate rather broad with V-shaped distal incision; internal skeleton large, the plate mostly occupied by the axis with U-shaped posterior arms, which are somewhat twisted, the axis very large and stout, extending beyond the plate nearly one-third its length.

Holotype (♂): Ta-chu-lan, Shaowu Hsien, Fukien, June 13, 1945 (Maa); in Museum of National Foochow University, Foochow. Allotype (♀): same locality as holotype; June 10, 1944 (Maa); in Museum of National Foochow University, Foochow. Paratypes: 1♂, 10♀♀, same locality as holotype, June 3-10, 1943-1945; 1♀, same locality, Aug. 13, 1943; 1♀, same locality, Sept. 29, 1943; 1♀, Tung-mu-kwan, Chungan Hsien, Fukien, May 17, 1945; 1♀, San-chiang, Chungan Hsien, Fukien, Aug. 12, 1945 (Lin); 3♀♀, Chien-men; Kwantseh Hsien, Fukien, 4♂♂, 74♀♀, Ta-chu-lan, Shaowu Hsien Fukien, April 28-Sept. 20, 1942-1945 (Maa) in Maa Collection; 1♂, 1♀, Sien-feng-ling, Chingan Hsien, Fukien, June 3-10, 1943, in Museum of Comparative Zoology; 1♂, 3♀♀, Ta-chu-lan, Shoawu Hsien,

Fukien, May 8-June 13, 1942-1943 (Maa), in Cheng Collection, Taipeh.

The color of the wing membrane of this species resembles that of *Neopanorpa ophthalmica* Navas and *sauteri* Esben-Petersen, but the markings are quite different. In *ophthalmica* and *sauteri*, the apical band is completely separated from the pterostigmal band and without rounded hyaline spots, whereas that of *caveata* n. sp. is usually connected with the pterostigmal band by some network-like bands and forms several rounded hyaline spots. The shape of the hypovalvae of the male and the very large axis of the female also make its recognition easy.

Neopanorpa tienmushana n. sp.

Figures 130, 134, 138, 167, 171, 292

Body mostly brown; vertex brown, with a narrow longitudinal median band posteriorly and a blackish brown mark enclosing ocelli; rostrum yellowish brown, with a black median longitudinal stripe on its distal half; thorax light brown; meso- and metanotum with a black median longitudinal streak; the 1st to 5th abdominal segments of male black dorsally, last few segments reddish brown, median process of 3rd tergite short, extending a little beyond the middle of the 4th tergite; the 1st to 9th abdominal segments of female uniformly blackish brown. Fore wing: length, ♂, 13-14 mm., ♀, 13-14 mm.; width, ♂ ♀, 3.4-3.5 mm. (holotype, length, 13 mm.; width 3.4 mm.); membrane yellow; markings deep brown; pterostigmal band complete, with a broad basal branch and narrow apical branch; basal band complete, narrow; apical band large, with a large prominent hyaline spot and sometimes also with a faint spot; basal spot small, marginal spot long, narrow, connected with the basal band; pterostigma not very prominent. Hind wing: length, ♂, 11.7-12.5 mm., ♀, 11.4-12.5 mm.; width, ♂, 3-3.5 mm., ♀, 3-3.2 mm.; similar to fore wing, except that the basal band is indicated only by a spot at the hind margin and both basal and marginal spots are entirely lacking. Male genitalia: genital bulb slender; the outer margin slightly concave at the middle, inner margin with a slightly projecting median portion and a small true basal lobe; hypandrium very long; hypovalvae stout, wide apart at base, their apical parts overlapping each other, the outer margins

concave at the middle, the inner margins straight, each with a proximal lobe, reaching to the middle of the harpagones; parameres very small, Y-shaped, the outer branches simple, connected with the lateral processes of the aedeagus, inner branches longer, with twisted narrow apices; preëpiproct narrowed towards apex, with a small U-shaped distal incision; aedeagus with the two apical processes united together, lateral processes extending upward, with tooth-like apex. Female genitalia: subgenital plate broad, with a wide V-shaped distal incision; internal skeleton small, U-shaped, the posterior arms rather sharp distally, broad basally, with a sclerotized bridge; no axis present.

Holotype (♂): Tien-mu-shan, Chekiang, June 6, 1936; in Museum of Institute of Zoology, Academia Sinica, Shanghai. Allotype (♀): Same collecting data and same type location as holotype. Paratypes: 3♂♂, 3♀♀, same locality as holotype, June 12, 1936, in Museum of Institute of Zoology, Academia Sinica, Shanghai; 1♂, 1♀, same locality as holotype, Aug. 15-19, 1936, in Museum of Comparative Zoology; 3♂♂, 2♀♀, same locality, June 6, 1936, 1♂, 3♀♀, same locality, July 9-26, 1936, in Cheng Collection, Taipeh.

This species, having deep yellow wing membranes, resembles the Formosan species, *Neopanorpa ophthalmica* Navas, in wing markings, but differs in the shape of the male genitalia. The length of the hypovalvae of *ophthalmica* is the same length as its hypandrium (Esben-Petersen, 1921), whereas that of *tienmushana* is much shorter than its hypandrium. The preëpiproct of *ophthalmica* is not narrowed toward the apex, and has only a slightly concave hind margin, whereas that of *tienmushana* is narrowed towards the apex, with a small U-shaped distal incision.

Neopanorpa huangshana n. sp.

Figures 135, 139, 166, 170, 291

Body reddish brown; vertex blackish brown anteriorly, with a black mark enclosing ocelli; rostrum reddish brown, with a deep brown longitudinal stripe on each side; thorax reddish brown, meso- and metanotum with black median longitudinal streak; the 1st to 5th abdominal segments of male black dorsally,

6th segment uniformly blackish brown, last few abdominal segments reddish brown, median process of 3rd tergite short, not extending beyond the middle of the 4th tergite; the 1st to 9th abdominal segments of female uniformly blackish brown. Fore wing: length, ♂, 12.5 mm., ♀, 13.2-14 mm.; width, ♂, 3 mm.; ♀, 3.5 mm. (holotype, length, 12.8 mm.; width, 3.2 mm.); membrane yellow, markings deep brown; pterostigmal band complete, with broad basal branch and apical branch; basal band complete, broader than that of *tienmushana;* apical band large, with small hyaline spot at the hind margin; basal spot small; marginal spot elongated, connected with the basal band; pterostigma not very prominent. Hind wing: length, ♂, 11 mm., ♀, 12-13 mm.; width, ♂, 3 mm., ♀, 3.3 mm.; similar to fore wing, except that the basal band is indicated only by a spot at the hind margin and both basal and marginal spots are entirely lacking. Male genitalia: similar to those of *tienmushana*, except that the outer margin of the hypovalvae are not concave, the inner margin is without the proximal lobe, the apex of the preëpiproct is rather truncated, without the small U-shaped distal incision, and the two apical processes of the aedeagus are slightly separated. Female genitalia: similar to those of *tienmushana*, except that the V-shaped distal incision of the subgenital plate is wider and the two bases of the posterior arms are smaller and are separated from each other more than those of *tienmushana*.

Holotype (♂): Huang-shan, Anhwei, June 19, 1936; in the Museum of Institute of Zoology, Academia Sinica, Shanghai. Allotype (♀): same locality as holotype; Aug. 5 ,1936; in same type location as holotypes. Paratypes: 1♀, same locality as holotype, June 21, 1936; in Cheng Collection, Taipeh.

This species resembles *Neopanorpa tienmushana* n. sp. superficially, but differs in the shape of the hypovalvae and especially in the absence of the small U-shaped incision at the distal end of the preëpiproct. This species also differs from *Neopanorpa ophthalmica* Navas by the short hypovalvae of the male and the more extensive wing markings.

Neopanorna claripennis Carpenter

Figures 131, 132, 136, 140, 168, 172

Neopanorpa claripennis Carpenter, 1938, Proc. Ent. Soc. Washington, 40(9):273, figs. 21 24.

Body mostly black; vertex black; rostrum uniformly light brown; median process of third abdominal tergite of male very short. Fore wing: length, 13 mm.; width, 3 mm.; wing membrane hyaline, slightly smoky, without color markings, although a few of the specimens have a very slight indication of gray distally; pterostigma large, dark gray, prominent. Hind wing: similar to the fore. Male genitalia: genital bulb elongate; coxopodites rather long; harpagones slender, with a prominent lobe on the inner margin proximally; hypandrium conspicuous; hypovalvae well-developed, reaching to the base of the harpagones, flattened apically and much broader distally than proximally. Parameres very small, filamentous; preëpiproct with nearly truncated apex; aedeagus with short apical processes, united with each other, lateral processes tooth-shaped, extending posteriorly. Female genitalia: subgenital plate broad, with small V-shaped incision posteriorly; internal skeleton small, U-shaped, the axis apparently entirely absent.

Holotype (♂): Beh-luh-din (6000 ft., 30 miles north of Chengtu) Szechwan, July 28, 1923 (D. C. Graham); in U. S. National Museum. Allotype (♀): Chengtu, Szechwan, 1936 (D. C. Graham); in U. S. National Museum.

Distribution: Beh-luh-din, Szechwan, July 23-Aug. 28, 1923 and 1933; Chengtu, Szechwan, 1936.

This species, without color markings, resembles *Neopanorpa apicata* Navas. However, according to Carpenter's idea, the tip of the wing of *apicata* shows a prominent darkening of the apex (hence the name *apicata*), whereas that of *claripennis* lacks the darkened apex. Also, in Navas' drawing, the wing of *apicata* gives no indication of a prominent pterostigma, whereas that of *claripennis* is made very prominent by its color. Unfortunately, according to Navas, the type of *apicata* (♂) lacks the terminal portion of the abdomen, so we shall never know the genital structure of the type.

Neopanorpa taoi Cheng

Figures 157, 158, 159, 160

Neopanorpa taoi Cheng, 1949, Psyche, **56**(4):155, figs. 10, 58, 66, 68.

Body light brown; vertex entirely black; rostrum light brown, with sooty brown stripe on each side; pronotum sooty brown, meso- and metanotum sooty brown on the median portion; the 1st to 5th abdominal segments of male sooty brown dorsally, last few abdominal segments brown in color, median process of third abdominal tergite short, with swollen and truncated apex, not extending beyond the middle of the fourth tergite. Under this process, there is a small median process and a pair of lateral processes; the fourth tergite is provided with a concave area on its anterior portion. Fore wing: length, 17 mm.; width, 3.8 mm.; membrane hyaline with slightly grayish tinge, no markings present; R_{2a} forked into R_{2a1} and R_{2a2}; pterostigma prominent. Hind wing: length, 15.8 mm.; width, 3.8 mm.; similar to the fore. Male genitalia: genital bulb slender; coxopodites long, narrow distally, bearing many long hairs; harpagones rather short, the outer margin convex near the base, furnished with a series of short barbs at the middle, inner margin with a large basal lobe which bears two tooth-like processes; hypandrium broad, hypovalvae wide apart basally, slightly overlapping each other distally, the basal outer margins greatly convex and strongly sclerotized; parameres simple, leaf-shaped; preëpiproct slender, with median concave margins, the distal outer portions extended laterally forming large, distal, tooth-like processes; aedeagus rather small, both apical processes and lateral processes tooth-like, extending the same direction and having nearly the same size.

Female unknown.

Holotype (♂): Mt. Lo, Sichang, Sikang, June 10, 1944 (Chia Chu Tao); in Cheng Collection, Taipeh.

This species, without any wing markings, differs from the other described *Neopanorpa* by the broadened apex of its median process of the third abdominal tergite and also by the structure of its male genitalia, especially the double-toothed basal lobes of the harpagones and the simple parameres.

Neopanorpa pilosa Carpenter

Figures 192, 193

Neopanorpa pilosa Carpenter, 1945, Psyche, **52**(1-2):75, text-figs. 1, 2.

Body light brown, the vertex, thoracic nota and first four abdominal tergites blackish brown; male with the median process of the third abdominal tergite well developed, reaching almost to the hind border of the fourth segment. Fore wing: length, 17.5 mm.; width, 3.8 mm., membrane nearly hyaline, faintly smoky in appearance; no markings: pterostigma pale yellow. Male genitalia: genital bulb slender, coxopodites very long; harpagones rather short, the outer margin concave near the base and with a large cluster of short black hairs near the middle; each of the harpagones has a prominent lobe on the inner margin near the base, bearing a number of long black hairs; similar hairs arise from a short papilla on the distal inner margin of coxopodites; hypandrium conspicuous; hypovalvae broad and long, reaching well beyond the base of the harpagones; each is folded along the outer margin; parameres small, branched; preëpiproct with a pair of thick, distal processes, enlarged distally and directed inward towards the interior of the bulb; both apical processes and lateral processes of the aedeagus tooth-like, extending in the same direction and having nearly the same size.

Female unknown.

Holotype (♂): Suifu (1000 ft.), Szechwan, Aug., 1928 (D. C. Graham); in U. S. National Museum.

Distribution: same as type.

This species, without any wing markings, resembles *Neopanorpa taoi* Cheng superficially, but differs in the structure of the male genitalia, especially the parameres. In *taoi*, the parameres are simple, leaf-like, whereas those of *pilosa* are branched. This species also bears some resemblance to *nigritis* Carpenter, but is much larger and has a lighter body. In *nigritis*, the outer margins of the harpagones of the male are normal and smooth, whereas those of *pilosa* are distinctly convex at their base.

Neopanorpa nigritis Carpenter

Figures 189, 190, 191, 207, 211, 219, 287

Neopanorpa nigritis Carpenter, 1938, Proc. Ent. Soc. Washington **40**(9): 274, figs. 17-20.

Body mostly black; vertex black; rostrum light brown, but with a wide, median black stripe along the anterior surface; the entire abdomen of male including genital bulb, black, though the tips of the genital harpagones are reddish brown; median process of third abdominal tergite well-developed, reaching almost to the hind border of the fourth segment; the entire abdomen of female like the male, black. Fore wing: length, 13 mm.; width, 3 mm.; wing membrane nearly hyaline, faintly smoky in appearance; no markings present; pterostigma well-developed, reddish brown. Hind wing: length, 12 mm.; width, 3 mm.; similar to the fore. Male genitalia: genital bulb slender, coxopodites long; harpagones only of moderate length, with a small lobe proximally on the inner margin; hypandrium not very conspicuous; hypovalvae slender, not quite reaching to the base of the harpagones, nearly membranous distally, their tips bent slightly; parameres simple, each consisting of a slender stalk, broader distally than proximally; preëpiproct slender, with abruptly broader distal portion, the apex slightly emarginate, the distal outer portion extended laterad to embrace the proctiger as shown in figure 190; aedeagus with short apical processes and tooth-like lateral processes. Female genitalia: subgenital plate broad, with a V-shaped distal incision; internal skeleton with the axis projecting beyond the plate, the two posterior arms being well-developed and reaching to the tips of the subgenital plate.

Holotype (♂): Mt. Omei (1000 ft.) Szechwan, July 19, 1936 (D. C. Graham); in U. S. National Museum. Allotype (♀): same collecting data and type location as holotype.

Distribution: Mt. Omei (7000-9000 ft.), Szechwan, July 19, 1936.

This species, without any wing markings, differs from the other described similar *Neopanorpa* by its short and slender hypandrium and hypovalvae. The wings of this species resemble those of *N. claripennis* Carpenter, but the body color, the median stripe on the rostrum, the long median process of the third abdominal tergite of the male and the large internal skeleton of the female make its recognition easy.

Neopanorpa validipennis Cheng

Figures 145, 146, 217, 222, 227, 288

Neopanorpa validipennis Cheng, 1949, Psyche, **56**(4):154, figs. 46, 47, 48, 64, 65.

Vertex entirely black; rostrum deep brown, with a median longitudinal light brown streak; thorax sooty brown dorsally, brown laterally, the 1st to 5th abdominal segments of male dark brown dorsally, reddish brown ventrally, 6th segment long, sooty brown, 7th segment reddish brown, 8th segment reddish brown anteriorly, sooty brown posteriorly; both the 7th and 8th segments broaden towards apex, the posterior end of the pleural regions of the 7th segment protruded posteriorly to form two small processes; median process of the third tergite rather long, extending nearly to the hind border of the 4th tergite, pointed at the apex when seen dorsally. Under this median process, there is another small reddish process, and on both sides of this median process is a pair of small tooth-like prolongations; the median axis of the 4th tergite slightly protruding upward. Fore wing: length, 14.5 mm.; width, 3.5 mm.; membrane slightly grayish brown, no markings present; veins very stout, R_{2a} usually forked into R_{2a1} and R_{2a2}; pterostigma not very prominent. Hind wing: length, 13.5 mm.; width, 3.5 mm.; similar to fore wing. Male genitalia: genital bulb slender; coxopodites very long, abruptly narrow distally, bearing a number of long hairs on the distal inner margins; harpagones short and slender, the outer margin slightly concave at the middle, furnished with a series of short barbs at the basal half, inner margin with a large lobe basally; hypandrium long, slightly narrowed towards apex; hypovalvae with slender basal stalks, wide apart basally, overlapping each other, the outer borders extending laterad and being concave near its middle; parameres club-shaped with rounded apex; preëpiproct slender with rounded apex, the distal outer portion extended laterad to embrace the proctiger, and forming distal tooth-like processes; aedeagus very small, the two apical processes nearly united, lateral processes extended posteriorly, sharp and tooth-like.

Female unknown.

Holotype (♂): Jihti (30 miles east of Tachienlu), Sikang,

Sept. 2, 1939 (F. Y. Cheng, Io Chou and Tein Ho Hei); in Cheng Collection, Taipeh.

Distribution: same as type.

This species, without any wing markings, differs from the other described *Neopanorpa* by the rounded basal lobes of the harpagones and the very long hypandrium and hypovalvae, which extend far beyond the base of the harpagones. The very stout veins of this species also make its recognition easy.

Neopanorpa apicata Navas

Neopanorpa apicata Navas, 1927, Rev. Acad. Ciene. Zaragosa, 7:27, fig. 6.

Head deep black; rostrum yellow; thorax entirely black; abdominal segments mostly black with yellow hairs; the terminal portion of the abdomen is lacking in the ♂ type. However, the last segment of the remaining abdomen is yellow. Fore wing: membrane hyaline, iridescent, no marking present, except a dark shadow at the wing apex; the inner margin of this shadow is straight, and the shadow disappears gradually posteriorly; between the veins there are longitudinal indistinct lines formed by the presence of the black hairs; veins black; pterostigma not prominent. Hind wing: similar to the fore wing. Both ♂ and ♀ genitalia are not known.

Type (♀): Kweichow (Cavalerie); originally in Navas Collection.

Distribution: same as type.

This species, having reduced wing markings, differs from other described *Neopanorpa* by the presence of the apical band and the absence of the other markings. I have not seen this species. The above account is based upon Navas' original description.

Neopanorpa choui Cheng

Figures 153, 154, 155, 161, 164, 165

Neopanorpa choui Cheng, 1949, Psyche, **56**(4):151, figs. 22, 23, 43, 44, 45, 62.

Body light brown, the middle part of the thoracic nota sooty brown; vertex entirely black; rostrum yellowish brown; median process of the third abdominal tergite of male extraordinarily long (measuring up to 4.2 mm.), apparently divided into two

portions and bearing a series of dense, short stiff hairs on its ventral surface; the fourth tergite extremely long, covering several of the following abdominal segments, somewhat elevated, and furnished with many short stiff hairs on its surface. Fore wing: length, 3.5 mm.; width, 3 mm.; membrane smoky hyaline, markings slightly brown, very indistinct; pterostigmal band incomplete, usually represented only by the faint basal branch and apical branch; basal band represented only by two small spots on the hind margin; apical band large; pterostigma brown, very prominent. Hind wing: length, 12 mm.; width, 3 mm.; similar to fore wing, except that the pterostigmal band and the basal band are entirely lacking. Male genitalia: genital bulb slender; coxopodites long, with truncated apex; harpagones slender, the outer margin concave at the middle, inner margin with a triangular angle and a large basal lobe; hypandrium short and broad; hypovalvae broad and less sclerotized, with an abruptly narrow apex, extending beyond the base of the harpagones; parameres modified into a pair of sclerotized rods, greatly swollen distally and with an incised apex and fused with the basal part of aedeagus basally; preëpiproct narrow distally, with truncated and slightly concave apex; aedeagus rather small, the two apical processes united together; lateral processes extending upward with tooth-like apex. Female genitalia: subgenital plate broad basally, narrowed towards apex, with a narrow U-shaped incision distally; internal skeleton large, the plate small, less sclerotized, its posterior arms narrow and slender, sword-shaped, the axis very stout, with abruptly curved hook-shaped basal ends.

Holotype (♂): Mt. Chowkung, Yaan, Sikang, July 14, 1939 (F. Y. Cheng, Io Chou and Tein Ho Hei); in Cheng Collection, Taipeh. Allotype (♀): same collecting data and type location as holotype.

Distribution: same as types.

This species, having very indistinct wing markings, differs from other described *Neopanorpa* by its very long median process of the third abdominal segment and the peculiar structures of both the male and the female genitalia.

Neopanorpa brisi (Navas)

Figure 188

Neopanorpa (?) *brisi* (Navas), Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9):280.

Leptopanorpa brisi Navas, 1930, Notes d'Ent. Chin. Mus. Heude, **1**(6):4. fig. 3.

Vertex yellowish brown anteriorly, black posteriorly; rostrum slender, brownish yellow with an inverted T-shaped mark at its base; thorax black dorsally, yellowish brown ventrally and laterally; 1st and 2nd abdominal segments black dorsally; median process of 3rd tergite with parallel margins and extending to the hind border of the 4th tergite, bearing a short golden fringe, 4th and 5th segments also black dorsally with a yellowish brown posterior margin, 6th segment partly cylindrical and partly conical, brownish yellow dorsally, with indistinct dark lines running lengthwise, 7th segment narrow, rather short and subcylindrical, narrow basally, obliquely truncated at the distal end; the upper lateral corner is bidentate; seen from above it is dilated posteriorly and cut off in a bow. Fore wing: length, 17 mm.; apex rounded, elliptical; membrane light grayish yellow, markings brownish yellow; only one long and narrow marking on the wing, the apex is somewhat darkened; veins black; among the veins and their branches there are dark longitudinal stripes. Hind wing: length, 15.5 mm.; similar to the fore, except that the longitudinal stripes are not so distinct as those of the fore wing. Male genitalia have not been worked out.

Female unknown.

Type (♂): Yunnan; in Navas Collection.

Distribution: same as type.

This species, having reduced wing markings, differs from other described *Neopanorpa* by the dark longitudinal stripes among their veins. The truncated apex of the 7th abdominal segment of the male also makes its recognition easy. I have not seen this species. The above account is based upon Navas' original description.

Neopanorpa kwangtsehi n. sp.

Figures 198, 202, 289

Vertex entirely black; rostrum grayish brown, with a pale white median longitudinal stripe; thorax yellowish brown, with a wide sooty brown median longitudinal band dorsally; abdominal segments of female sooty brown dorsally, yellowish brown laterally and ventrally. Fore wing: length, 13.5 mm.; width, 3.15 mm.; membrane slightly brown, markings light grayish brown, indistinct; pterostigmal band complete, with complete basal branch and apical branch; basal band interrupted, not prominent; apical band large, with three windows; basal spot absent; marginal spot very small; pterostigma prominent, deep brown. Hind wing: length, 12.2 mm.; width, 3 mm.; no markings present, except for a slight suspicion of grayish brown at the apex of wing and deep brown at the pterostigma. Female genitalia: subgenital plate broad, with truncated apex; internal skeleton large, the plate with concave anterior margin, posterior arms of the plate U-shaped, axis prominent, but not extending beyond the plate.

Male unknown.

Holotype (♀): Chinmen, Kwangtseh, Fukien, Aug. 22, 1945 (Maa); in Maa Collection.

This species, having indistinct wing markings, differs from the other described *Neopanorpa* by the truncated apex of the subgenital plate and the shape of the internal skeleton.

Neopanorpa hehi Cheng

Figures 156, 162, 163, 212, 213, 293

Neopanorpa hehi Cheng, 1949, Psyche, **56**(4):152, figs. 35, 36, 49, 50, 51.

Vertex entirely black; rostrum uniformly brown; thorax sooty brown dorsally, deep brown laterally; the 1st to 5th abdominal segments of male sooty brown dorsally, deep brown laterally and ventrally, 6th abdominal segment twice the length of 5th segment, sooty brown in color, last three abdominal segments also very long, deep brown in color; median process of the third tergite short, never extending to the middle of the fourth tergite, and in contact with the conical projection on the median axis of

the fourth tergite; abdominal segments of female sooty brown dorsally, deep brown laterally and ventrally. Fore wing: length, ♂, 12.8 mm.; ♀, 13.5 mm.; width, ♂, 3.2 mm.; ♀, 3 mm.; membrane slightly brown, markings sooty brown; pterostigmal band complete, with a broad basal branch and a greatly reduced and separated apical branch; basal band represented by a reduced marking on the hind margin; apical band well developed; basal spot very small; marginal spot consisting of two reduced spots; pterostigma prominent. Hind wing: length, ♂, 11.5 mm.; ♀, 12.2 mm.; width, ♂, 3.2 mm.; ♀, 3 mm.; similar to fore wing, except that apical branch of pterostigmal band, basal band, basal spot and marginal spot are entirely lacking. Male genitalia: genital bulb slender; coxopodites rather long, with a protruding apex; harpagones very slender, the outer margin slightly concave at the middle, inner margin with a smooth angle and a true basal lobe; hypandrium rather long; hypovalvae not flattened, broadend towards the apex, the basal portion wide apart, the median inner parts greatly prolonged upward and overlapping each other; parameres apparently absent; preëpiproct slightly narrowed towards the apex, the distal portion bent laterad and caudad so as to embrace the proctiger; aedeagus very small, both the apical and the lateral processes tooth-like, the basal part usually covered by a pair of elliptical membranous plates. Female genitalia; subgenital plate broad, with a wide U-shaped distal incision; internal skeleton small, the plate being band-shaped, transversely elongated, the posterior arms of the internal skeleton lanceolate, extending laterad and reaching to the side margins of the subgenital plate; the axis small, fork-shaped, the distal portion of the forks joined closely with the basal posterior arms.

Holotype (♂): Mt. Chowkung, Yaan, Sikang, July 29, 1939 (F. Y. Cheng, Io Chou and Tein Ho Hei); in Cheng Collection, Taipeh. Allotype (♀): same collecting data and deposition as holotype.

Distribution: same as types:

This species superficially resembles *Neopanorpa cavaleriei* Navas in the wing markings, but it can be distinguished by the smaller wing size, the greatly reduced apical branch of the pterostigmal band in the fore wing and the entire lack of this

band in the hind wing. Another difference is the unforked R_{2a} of this species as compared with the forked R_{2a} in the redescribed figure of *cavaleriei* by Esben-Petersen (1921, fig. 93). This species also resembles *N. chelata* Carpenter, in wing markings, but these two species are at once distinguished by the forms of both the male and the female genitalia.

Neopanorpa chelata Carpenter

Figures 169, 173, 186, 194, 195, 216, 299

Neopanorpa chelata Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9): 274, figs. 13-16.

Body brown and black; vertex black; rostrum light brown; thorax mostly brown, with a wide median dorsal black stripe; abdomen black above, the segments beyond the fifth reddish brown, median process of the third abdominal tergite prominent, with rounded posterior margin. Fore wing: length, 14 mm.; width, 3 mm.; membrane hyaline, markings sooty brown, apical ban dpresnt, but usually interrupted posteriorly; pterostigmal band entire, with broad basal branch and very narrow apical branch; basal band interrupted, represented as three spots; basal spot absent; marginal spot present; pterostigma rather prominent. Hind wing: length, 13 mm.; width, 3 mm.; similar to fore wing. Male genitalia: genital bulb slender; coxopodites rather long; harpagones unusually long and slender, with a prominent proximal lobe on the inner margin; hypandrium conspicuous; hypovalvae broad, especially distally, each possessing an outer small apical lobe, reaching to the base of the harpagones; parameres greatly reduced, mostly united with aedeagus; preëpiproct slender, with round distal margin; apical processes of aedeagus short, united with each other, lateral processes short, tooth-like. Female genitalia: subgenital plate broad, abruptly narrowed posteriorly, with a narrow V-shaped distal incision; internal skeleton small, posterior arms U-shaped, axis apparently absent.

Holotype (♂): Shinkaisi, Mt. Omei, Szechwan, Aug. 16-20, 1934; in U. S. National Museum. Allotype (♀): same collecting data and type location as holotype.

Distribution: same as holotype; Chengtu, Szechwan, 1936;

foot of Mt. Wa (6000-7000 ft.), Szechwan, July 27, 1925; Kuanshien, Szechwan, 1936.

This species resembles *Neopanorpa cavaleriei* Navas. However, the median process of the third abdominal tergite of *cavaleriei* is narrow and long, almost reaching to the fifth segment, whereas that of *chelata* is short and broad. Moreover, the wing size of *cavaleriei* is larger than that of *chelata*.

Neopanorpa cavaleriei Navas

Neopanorpa cavaleriei Navas, 1908, Mem. Real. Acad. Ciene. Barc., 1908:417. Esben-Petersen, 1921, Coll. Zool. Selys Long., **5**(2):83, figs. 93, 94. Navas, 1926, Mem. Pont. Accad. Nuovi Lincei, **9**:920. *Id.*, 1930, Rev. Brot., **24**(1):13. Carpenter, 1945, Psyche, **50**(1-2):74, text-figs. 4, 7.

Head castaneous; rostrum reddish brown; thorax reddish brown dorsally, sides yellowish brown with some small linear black spots; abdomen reddish brown, the hind border of third tergite narrow and long, almost as long as the fourth segment; 6th segment cylindrical, a little narrowed towards apex; 7th segment one-fourth shorter than 6th, a little incrassated towards apex; 8th as long as 7th, thickened towards apex, which is obliquely truncated above. Fore wing: length, 16 mm.; elliptical at tip; membrane hyaline, with a faint yellowish tinge, markings blackish brown; pterostigmal band complete, with a narrow basal branch and a narrow apical branch; basal band indicated by two small spots; apical band large, with an oblique prolongation at the middle of its inner margin, connected along the anterior margin with the pterostigmal band; basal spot absent; marginal spot very small; pterostigma not very prominent; longitudinal veins and basal crossveins reddish brown, the apical crossveins not very distinct, R_{2a} forked into R_{2a1} and R_{2a2}. Hind wing: length, 14.5 mm.; similar to the fore, except that the small spot which represented the marginal spot in the fore wing is entirely absent. Male genitalia of this species has not been worked out. However, according to Esben-Petersen, the hypovalvae are rather stout, the interior margins running close together, but forming a circular hole at their base; preëpiproct is rounded at tip with long setae.

Female unknown.

Type (♂): Kweiyang, Kweichow, 1906 (Cavalerie); in Muséum National d'Histoire Naturelle, Paris.

Distribution: same as type; Tokin, Indo-china.

This species resembles *Neopanorpa chelata* Carpenter in the wing markings, but has a larger wing size. The median process of the third abdominal tergite of this species is narrow and long, almost reaching to the fifth segment, whereas that of *chelata* is short and broad. Unfortunately, the male genitalia of the type specimen of *cavaleriei* have not been worked out.

Neopanorpa lacunaris Navas

Neopanorpa lacunaris Navas, 1930, Notes d'Ent. Mus. Heude, 1(6):3, fig. 2.

Head brownish yellow; vertex black with a deep black spot within ocelli; rostrum brownish yellow, with a black stripe along each side; thorax brownish yellow, pronotum black, the first abdominal segment brownish yellow dorsally and ventrally; 2nd to 5th segments black dorsally, brownish yellow ventrally; 6th segment conical, black, with brownish yellow apex; the latter is truncated and rounded; the 8th segment tawny yellow, with the same shape and same length as in the 7th segment, except that its posterior border is obliquely truncated; the 9th segment globular, rusty brick-color, covered with black hairs; the median process of third tergite has parallel sides and extends a little beyond the tip of the fourth tergite; its apex is covered with dark hairs. Fore wing: length, 12.5 mm.; narrow, with rounded, elliptical apex, membrane hyaline, very light yellow in the basal third, markings black; pterostigmal band broad, forked posteriorly, both basal and apical branches are broad; basal band indicated by two transverse markings, one anterior and the other posterior; apical band broad, with a small hyaline spot posteriorly; basal spot absent; marginal spot present; veins black. Hind wing: length, 11.4 mm.; similar to the fore, except that the basal bands are not so distinct. Male genitalia have not been worked out.

Female unknown.

Type (♂): Yunnan; originally in Navas Collection.

Distribution: same as type.

This species differs from the other described, distinctly

marked, *Neopanorpa* by the hyaline spot bearing an apical band, the forked pterostigmal band and the interrupted basal band. I have not seen the species. The above account is based upon Navas' original description.

Neopanorpa translucida n. sp.

Figures 147, 148, 197, 201, 218, 223, 295

Body yellowish brown; vertex brown with a sooty mark enclosing ocelli; rostrum uniformly brown; thorax yellowish brown laterally with four black spots, the middle of the meso- and metanotum deep brown, the anterior portion usually deep brown in color; the 1st to 5th abdominal segments of male deep brown dorsally, 6th segment long, deep brown with somewhat restricted reddish brown apex, the 7th and 8th segments rather short and stout, reddish brown in color; median process of the 3rd tergite rather long, a little extended beyond the hind margin of the 4th tergite; the 1st to 5th abdominal segments of female deep brown dorsally, last few segments slightly reddish brown. Fore wing: length, 14.5 mm.; width, 3.7 mm.; membrane slightly yellowish brown, markings brown; pterostigmal band complete with broad basal branch and apical branch; basal band irregular; apical band very large with two hyaline spots, usually joined to the pterostigmal band by two very narrow bands; basal spot very small; marginal spot represented by an inverted Y-shaped band; pterostigma prominent. Hind wing: length, 13 mm.; width, 3.5 mm.; similar to fore wing, except that the basal band and the marginal spot are entirely lacking. Male genitalia: genital bulb slender; coxopodites long, with a bundle of 4-5 black hairs on their distal inner margins and a row of short hairs along its anterior inner margin; harpagones with broad base and slender flattened distal portion, the outer margin concave at the middle, inner margin with a small median angle and a very large square-shaped basal lobe which is concave ventrally; the inner margins of this lobe bear a dense row of black hairs, while its posterior margins bear a row of comb-like brown hairs; hypandrium rather long; hypovalvae elongated, very broad in lateral view with rounded apex, extending a little beyond the base of the harpagones; parameres very short, Y-shaped, the

inner branches free, the outer branches shorter than the inner pair, less sclerotized and fused with the basal part of aedeagus; preëpiproct somewhat restricted at its median margins and with slightly concave distal apex; aedeagus small, the apical processes united together, the lateral processes being sharp and tooth-like, extending outward and upward. Female genitalia: subgenital plate rather broad with deep V-shaped distal incision; internal skeletons rather large, the plate mostly occupied by the axis with U-shaped posterior arms which are somewhat twisted, the axis short and stout with sharp anterior end, extending only a little beyond the plate.

Holotype (♂): Ta-chu-lan, Shaowu Hsien, Fukien, May 18, 1945 (Maa); in Museum of National Foochow University, Foochow. Allotype (♀): Same locality as holotype, Aug. 7, 1945 (Maa); in Maa Collection. Paratypes: 1♂, Tao-shui, Shaowu Hsien, Fukien, June 17, 1943; 8♂♂, same locality as holotype; May 10-June 10, 1944-1945 (Maa), in Museum of National Foochow University; 1♂, Pen-tien-tung, Changting Hsien, Fukien, April 22, 1941; 1♂, Chien-men, Kwantseh Hsien, Fukien, Aug. 22, 1945; 34♂♂, 3♀♀, same locality as holotype, April 1-Aug. 20, 1942-1945 (Maa), in Maa Collection; 2♂♂, 1♀, same locality as holotype, May 8-Aug. 19, 1942-1945 (Maa), in Museum of Comparative Zoology; 5♂♂, 2♀♀, same collecting data, in Cheng collection, Taipeh.

The wing markings of this species somewhat resemble those of *Neopanorpa caveata* n. sp. However, the color of the markings and the wing membrane are much lighter than those of the latter. The shape of the harpagones and hypovalvae of the male and the short axis of the female also enable it to be easily distinguished as a distinct species.

Neopanorpa pielina Navas

Figures 151, 152, 206, 210, 301

Neopanorpa pielina Navas, 1936, Notes d'Ent. Mus. Heude, 3(4):58, figs. 72, 73.

Vertex reddish brown, with black spot between ocelli; rostrum shining reddish brown; thorax blackish brown dorsally, reddish brown laterally; the 1st to 5th abdominal segments of male

blackish brown dorsally, reddish brown ventrally, 6th abdominal segment black, with narrow reddish brown posterior border, last three abdominal segments reddish brown; median process of the third tergite long and slender, extending to the hind border of the fourth tergite, the anterior portion of the latter concave at the middle, with reddish brown color; abdominal segments of female blackish brown dorsally, reddish brown ventrally. Fore wing: length, ♂, 11.5 mm.; ♀, 12.5 mm.; width, ♂, 3 mm.; ♀, 3.2 mm.; membrane dusky hyaline, markings sooty brown; pterostigmal band complete, with broad basal branch and narrow apical branch; the anterior portion of the pterostigmal band extends outward and forms a small spot posterior to the pterostigma; basal band represented by two spots; apical band broad, with a large hyaline spot posteriorly; basal spot absent; marginal spot present; pterostigma prominent. Hind wing: length, ♂, 10.5 mm.; ♀, 11.5 mm.; width, ♂, 3 mm.; ♀, 3.2 mm.; similar to fore wing, except that the basal band is represented by only one spot. Male genitalia: genital bulb slender; coxopodites long, with truncated apex and a row of bristles on its distal inner margins; harpagones slender, the outer margins slightly concave at the middle, inner margins with a smooth median angle and a basal concave area; hypandrium conspicuous; hypovalvae broad, restricted proximally, their outer margins bent, with broader distal folded portion, extending far beyond the base of the harpagones; parameres small, Y-shaped, united with aedeagus and supported by a weakly sclerotized V-shaped bar; preëpiproct broad basally with rounded apex, its distal outer margins bearing a pair of small bent lobes; aedeagus small, the apical processes united together, lateral processes lobe-shaped. Female genitalia: subgenital plate broad at the middle, with a wide V-shaped distal incision; internal skeleton large, the outer margins of the plate less sclerotized, the posterior arms of the plate broad at the middle, abruptly narrowed apically, the axis long, enclosed by the strongly sclerotized extended posterior portion of the plate.

Types (♂ ♀): Kuling, Kiangsi, Aug. 13-16, 1935 (Piel); in Heude Museum, Shanghai.

Distribution: same as types.

This species, having complete basal and apical bands (with a hyaline spot), differs from the other described *Neopanorpa* by the peculiar structures of both the male and the female genitalia. i.e., no true lobes in the harpagones of the male and the long axis of the internal skeleton of the female. The latter usually occurs with a subgenital plate that has a wide V-shaped distal incision. The description and drawings of both the male and the female of this species are based upon the specimens labeled as paratypes in the Heude Museum, Shanghai.

Neopanorpa mutabilis n. sp.

Figures 141, 142, 205, 209, 221, 226

Body mostly blackish brown; vertex deep grayish brown with sooty brown mark enclosing ocelli; rostrum uniformly deep grayish brown; thorax deep grayish brown dorsally, meso- and metanotum with broad blackish brown streak; the 1st to 5th abdominal segments of male blackish brown dorsally, 6th segment long, blackish brown, 7th and 8th segments shorter than the 6th, reddish brown in color; median process of the 3rd tergite short, never extending beyond the hind margin of the 4th tergite; the anterior median portion of the 4th tergite less sclerotized, forming a light brown square-shaped area; the 1st to 6th abdominal segments of female blackish brown dorsally, last few abdominal segments reddish brown. Fore wing: length, ♂, 12.6 mm., ♀, 13.5 mm.; width, ♂, 3.5 mm., ♀, 3.7 mm.; membrane hyaline, markings sooty brown; pterostigmal band complete with broad basal branch and a comparatively narrow apical branch; basal band represented by two short bands which in some individuals connect with each other; apical band large with a hyaline spot posteriorly; between the apical band and the pterostigmal band there is usually a narrow additional band extending from the pterostigmal area to the hind margin of wing but in some individuals, this band is interrupted, the anterior half connected with the apical band to form a large hyaline window; basal spot absent; marginal spot elongated, band-like; pterostigma not very prominent. Hind wing: length, ♂, 11.6 mm., ♀, 12.2 mm.; width, ♂, 3.6 mm., ♀, 3.2 mm.; similar to the fore. Male genitalia: genital bulb slender; coxo-

podites long with a row of hairs on its distal inner margin; harpagones slender, the outer margin slightly concave at the middle, inner margin with a large basal concave area; hypandrium broad; hypovalvae long, broadened at their median portion, extending far beyond the base of harpagones; parameres very inconspicuous, weakly sclerotized, consisting of a narrow stalk, which gives rise to two branches, the inner branch free, the outer branch united with the lateral process of the aedeagus; preëpiproct narrowed towards its apex with slightly concave distal margin; aedeagus small, the apical processes united together, lateral processes tooth-like, extending outward and upward. Female genitalia: subgenital plate broad at the middle with narrow U-shaped distal incision; internal skeleton large, the plate mostly occupied by the long axis; posterior arms of the plate swollen at their outer margins.

Holotype (♂): Ta-chu-lan, Shaowu Hsien, Fukien, June 3, 1945 (Maa); in Museum of National Foochow University, Foochow. Allotype (♀): same locality as holotype; May 25, 1945 (Maa); in Museum of National Foochow University, Foochow. Paratypes: 11 ♀ ♀, same locality as holotype, May 10-June 10, 1945 (Maa), in Museum of National Foochow University, Foochow; 31 ♂ ♂, 64 ♀ ♀, same locality as holotype, April 23-June 13, 1942-1945; 5 ♀ ♀, Changting Hsien, Fukien, April 30-June 3, 1942-1945 (Maa and Lin), in Maa Collection; 2 ♂ ♂, 2 ♀ ♀, same collecting data as holotype, in Museum of Comparative Zoology; 2 ♂ ♂, 2 ♀ ♀, same collecting data, in Cheng Collection, Taipeh.

This species differs from previously described *Neopanorpa* by its wing markings, especially the presence of the additional band which extends from the outer part of the pterostigma to the apical band to form a large hyaline window. The structures of both the male and the female genitalia are also specific characters.

Neopanorpa ovata n. sp.

Figures 149, 150, 187, 298

Body deep brown; vertex blackish brown with black mark enclosing ocelli; rostrum deep brown; thorax blackish brown dorsally; the 1st to 5th abdominal segments of male blackish

brown, 6th segment long, slightly blackish brown, last few abdominal segments deep brown; median process of 3rd tergite rather long, reaching to the hind border of the 4th tergite, the median portion of the 4th tergite projecting to form a convex process which is situated behind the light brown square area of this tergite. Fore wing: length, 13 mm.; width, 3.4 mm.; membrane hyaline, markings brown; the wing apex rather rounded; pterostigmal band complete, with broad basal branch and narrow apical branch; basal band represented by two large spots; apical band complete, with two hyaline spots, the additional band between the apical band and the pterostigmal band as in *Neopanorpa mutabilis* n. sp.; basal spot absent; marginal spot large; pterostigma prominent. Hind wing: length, 12.2 mm.; width, 3.2 mm.; similar to fore wing, except that the basal band is represented only by a single spot. Male genitalia: genital bulb slender; coxopodites long with a row of hairs on their distal inner margins; harpagones slender, the outer margin slightly concave at the middle, inner margin slightly convex at the middle with a well developed basal concave area; hypandrium very broad; hypovalvae broad and stout, these distal outer portions usually prolonged to form a broad lobe, which is folded upward to embrace the hind part of the preëpiproct; parameres absent; preëpiproct slender, with truncated apex, rather broad a short distance behind its apex; aedeagus strongly sclerotized, with tooth-like apical and lateral processes.

Female unknown.

Holotype (♂): Pen-tien-tung, Changting Hsien, Fukien, April 22, 1941 (Maa); in Maa Collection, Taipeh.

This species is very similar to *Neopanorpa mutabilis* n. sp., but its rounded wing apex and its very broad hypovalvae enable it to be easily separated as a distinct species.

Neopanorpa maai n. sp.

Figures 143, 144, 196, 200, 220, 224, 296

Body very weak, yellowish brown; vertex grayish brown; rostrum uniformly light yellowish brown; thorax grayish brown dorsally, meso- and metanotum with deep grayish brown broad median longitudinal streak; the 1st to 5th abdominal segments of male brown dorsally, 6th segment not so prolonged as in

Neopanorpa mutabilis n. sp., brown in color, last few abdominal segments light reddish brown; median process of 3rd abdominal tergite long, extending a little beyond the hind margin of the 4th tergite, the median portion of the 4th tergite less sclerotized, forming a light brown square area, which is much smaller than that of *mutabilis;* the 1st to 9th abdominal segments of female uniformly yellowish brown. Fore wing: length, 14 mm.; width, 3.8 mm.; membrane hyaline, markings slightly gray; pterostigmal band complete with a broad basal branch and a separate apical branch; basal band complete, irregular; apical band large with a median hyaline band; between the apical band and the pterostigmal band there is an additional band, as in *mutabilis*, the middle portion of this band being usually connected with the apical branch of the pterostigmal band; basal spot absent; marginal spot elongated; pterostigma not prominent. Hind wing: length, 12.5 mm.; width, 3.5 mm.; similar to the fore. Male genitalia: genital bulb slender; coxopodites long with a row of short hairs on their distal inner margins; harpagones slender, the outer margin slightly concave at the middle, inner margin with a rounded angle and a basal concave area which is not so developed as in *mutabilis;* hypandrium broad; hypovalvae shorter than those of *mutabilis*, extending a little beyond the base of the harpagones; parameres absent; preëpiproct broad at the middle, slender distally with slightly concave distal margin; aedeagus small, the apical processes united together, lateral processes tooth-like, short. Female genitalia: subgenital plate broad at the middle with deep and narrow V-shaped distal incision; the length of axis is the same as that of the posterior arms of the plate.

Holotype (♂): Ta-shu-lan, Shaowu Hsien, Fukien, April 24, 1944 (Maa); in Museum of National Foochow University, Foochow. Allotype (♀): Li-chia-tun, Kienyang Hsien, Fukien, April 18, 1945 (Maa); in Museum of National Foochow University, Foochow. Paratypes: 2♀♀, same collecting data as holotype, in Museum of National Foochow University, Foochow: 2♂♂, 5♀♀, same locality as holotype, April 20-May 8, 1942-1945 (Maa and Lin), in Maa collection; 1♀, same collecting data as holotype, in Museum of Comparative Zoology; 1♂, 1♀, San-chiang, Chungan Hsien, Fulkien, May 8-19, 1943 (Maa), in Cheng Collection, Taipeh.

I have named this species in honor of Mr. Maa, who has been so kind as to allow me the loan of his collection.

This species somewhat resembles *Neopanorpa mutabilis* n. sp., but the gray color of the wing markings, the shorter last few abdominal segments of the male and the short axis of the female internal skeleton make its recognition easy.

Neopanorpa banksi Carpenter

Figures 177, 181

Neopanorpa banksi Carpenter, 1938, Proc. Ent. Soc. Washington, **40**(9): 275, figs. 25, 26.

Body mostly black above; vertex black; last few abdominal segments brown, the others black above. Fore wing: length, 15 mm.; width, 3 mm.; membrane hyaline; markings sooty brown; pterostigmal band interrupted, with same broad basal branch, but no apical branch; basal band reduced to a few spots; apical band entire, but narrowed posteriorly. Hind wing: similar to the fore. Female genitalia: subgenital plate broad, with a small U-shaped distal incision; internal skeleton large, the axis absent, but with three well developed plates at the base of the long, posterior arms, which reach to the tip of the subgenital plate.

Male unknown.

Holotype (♀): Suifu, Szechwan (D. C. Graham); in U. S. National Museum.

Distribution: same as holotype.

This species, having distinct wing markings, differs from other described *Neopanorpa* by the peculiar shape of the internal skeleton, which has three plates at the base of the long posterior arms.

Neopanorpa varia Cheng

Figures 214, 215, 294

Neopanorpa varia Cheng, 1949, Psyche, **56**(4):157, figs. 41, 42, 56.

Body light brown, black above, last few abdominal segments brown; vertex entirely black; rostrum light brown, with black stripe on each side. Fore wing: length, 14 mm.; width, 3.2 mm.; membrane hyaline, markings sooty brown; pterostigmal band

complete, with a separated basal branch and a narrow apical branch; apical band complete; pterostigma prominent. Hind wing: length, 13 mm.; width, 3.3 mm.; similar to fore wing, except that the basal band is represented by a small marking on the hind margin. Female genitalia: subgenital plate broad, with a U-shaped distal incision; internal skeleton large, U-shaped, posterior arms rather long, obtuse distally, very large basally, with a narrow selerotized bridge and a rounded membranous portion between them; axis apparently absent.

Male unknown.

Holotype (♀): Heierhwan (100 miles south of Tachienlu), Sikang, Sept. 20, 1939 (F. Y. Cheng, Io Chou and Tein Ho Hei); in Cheng Collection, Taipeh.

Distribution: Heierhwan, Sikang, Sept. 20, 1939; Jihti (20 miles east of Tachienlu), Sikang, Sept. 9, 1939; Wantung (50 miles south of Tachienlu), Sikang, Sept. 17, 1939.

This species is somewhat variable with regard to the markings of the wings. In my collection, there is one individual collected in Wantung, Sikang, with a greatly reduced pterostigmal band on both fore and hind wings and without the basal band on the hind wing.

The wings of this species resemble those of *Neopanorpa dimidiata* Navas superficially. However, in *dimidiata* the apical band is well developed, with a faint hyaline spot, whereas that of *varia* is interrupted posteriorly and without a hyaline spot. Moreover, the body color of these two species differs very much.

Neopanorpa cantonensis n. sp.

Figures 175, 179, 302

Body mostly black: vertex blackish brown, with a black mark enclosing ocelli; rostrum reddish brown, with blackish brown longitudinal stripe on each side; thorax brown laterally, with some obscurely blackish brown maculations, meso- and metanotum brown, with very broad blackish brown median streak; the 1st to 6th abdominal segments of female black dorsally, last few segments yellowish brown. Fore wing: length, 13 mm., width, 3 mm.; membrane hyaline, markings blackish brown; pterostigmal band very broad, complete, with broad basal branch and apical

branch; basal band complete; apical band large, connected with pterostigmal band at the costal margin; both basal and marginal spots present, elongated; pterostigma not prominent. Hind wing: length, 12 mm.; width, 2.9 mm.; similar to fore wing, except that both basal and marginal spots are entirely lacking. Female genitalia: subgenital plate broad at the middle portion, with wide V-shaped distal incision; internal skeleton small, U-shaped, posterior arms rather sharp distally, their basal outer margins smoothly curved, connected to each other by a bridge, which is covered by a rounded large membranous part; no axis present.

Male unknown.

Holotype (♀): Canton, Kwangtung; in Heude Museum, Shanghai.

This species differs from other described *Neopanorpa* by its very broad wing markings and the presence of the basal spot. The peculiar structures of the female genitalia also make its recognition easy.

Neopanorpa dimidiata Navas

Neopanorpa dimidiata Navas, 1930, Notes d'Ent. Chin. Mus., 1(6):2, fig. 1.

Vertex black, with a rusty yellow line running lengthwise near the eyes; rostrum yellowish brown, with a black spot on its upper surface; thorax dull yellow, with a deep black median band dorsally; 1st to 6th abdominal segments dull yellow, with a broad median band running lengthwise on the dorsum, the last few abdominal segments dirty yellow. Fore wing: length, 15.5 mm.; apex of wing rounded in an elliptical fashion; membrane appears smudged or very lightly touched with rust; markings sooty brown; pterostigmal band broad, with complete apical branch, which is narrow posteriorly; basal branch of pterostigmal band interrupted, represented by a spot at the anal margin of the wing; basal band absent; apical band broad, complete, with curved inner border and a faint window posteriorly. Both basal and marginal spots are absent; veins black and strongly developed. Hind wing: length, 15 mm.; similar to the fore. Female genitalia have not been worked out.

Male unknown.

Type (♀): Yunnan; originally in Navas Collection.

Distribution: same as type.

This species resembles *Neopanorpa varia* Cheng in the structure of the pterostigmal band of the wing, but differs in the apical band. In *varia*, the apical band is interrupted posteriorly, without a hyaline spot, whereas that of *dimidiata* is well developed, with a faintly hyaline spot posteriorly. I have not seen this species. The above account is based upon Navas' original description.

Neopanorpa pulchra Carpenter

Figures 182, 183

Neopanorpa pulchra Carpenter, 1945, Psyche, **52**(1-2):75, text-fig. 6, pl. 11, fig. 12.

Body light brown, slightly darker above. Fore wing: length, 14 mm.; width, 3 mm.; membrane hyaline, markings grayish brown; pterostigmal band broad, complete, with broad basal branch and narrower apical branch; basal band complete; apical band wide and entire, contiguous with pterostigmal band along costal margin; basal spot absent; marginal spot present, small; pterostigma not very prominent. Hind wing: length, 12.5 mm.; width, 3 mm.; similar to fore wing. Female genitalia: subgenital plate broad, with a shallow distal notch; internal skeleton broader than long, with widely divergent arms and no axis.

Male unknown.

Holotype (♀): Ta-han, Hainan Island, Kwangtung, June 23, 1935 (L. Gressitt); in Museum of Comparative Zoology.

This species has the general wing pattern of *Neopanorpa cantonensis* n. sp., but the wing is more slender and the basal spot is absent. It also resembles *N. parva* Carpenter superficially, but has more extensive markings. The internal skeleton of this species differs from that of *parva* by the widely divergent arms.

Neopanorpa parva Carpenter

Figures 184, 185

Neopanorpa parva Carpenter, 1945, Psyche, **52**(1-2):73; text-figs. 3, 5, pl. 11, fig. 13.

Body light to dark brown; vertex, thoracic nota and abdom-

inal tergites darker. Fore wing: length, 11-13 mm.; width, 2-2.8 mm. (holotype, length, 11 mm.; width, 2 mm.); membrane hyaline, markings grayish brown; pterostigmal band wide, with broad basal branch and narrower apical branch; basal band interrupted, represented by two narrow bands; apical band broken posteriorly; basal spot absent; marginal spot appearing as an elongated narrow band. Hind wing: length, 10 mm.; width, 2 mm. (holotype); similar to the fore. Female genitalia: subgenital plate rather broad, with a wide U-shaped distal incision; internal skeleton small, with nearly parallel arms and very short median axis.

Male unknown.

Holotype (♀): Kwanshien, Szechwan, July 16, 1937 (G. Liu); in Museum of Comparative Zoology.

Distribution: same as holotype.

This species has wing markings resembling those of *Neopanorpa cavaleriei* Navas, but it is much smaller than the latter and the wing membrane is hyaline, not slightly yellowish as in *cavaleriei*. The short median axis of the internal skeleton of the female makes its recognition easy.

Neopanorpa chaoi n. sp.

Figures 174, 178

Body yellowish brown; vertex deep brown with a sooty brown mark enclosing ocelli; rostrum reddish brown frontally, yellowish brown laterally; thorax yellowish brown laterally with few black spots, deep brown dorsally, meso- and metanotum with a median longitudinal sooty brown streak; 1st to 6th abdominal segments of female deep brown dorsally, last few segments reddish brown. Fore wing: length, 12.5 mm.; width, 3.2 mm.; membrane hyaline, markings brown; pterostigmal band complete with broad basal branch and apical branch; basal band complete; apical band prominent with two hyaline spots and partly united with the pterostigmal band at the pterostigmal area; basal spot present, two in number; marginal spot bandlike, united with the basal band at the median portion of wing; pterostigma not prominent. Hind wing: length, 11.2 mm.; width, 3.1 mm.; similar to fore wing, except that the basal band

is not so developed and both basal and marginal spots are entirely lacking. Female genitalia: subgenital plate rather broad with a wide V-shaped distal incision; internal skeleton small, V-shaped, posterior arms blade-shaped with rather sharp posterior ends and stout bases which are connected to each other by a small strongly sclerotized bridge and a large membranous part; no axis present.

Male unknown.

Holotype (♀): Li-chia-tun, Kienyang Hsien, Fukien, Aug. 11, 1945 (Maa); in Museum of National Foochow University, Foochow. Paratypes: 3♀♀, Ta-chu-lan, Shaowu Hsien, Fukien, May 21-June 9, 1942-1943, 1♀, Yao-tou, Kienyang Hsien, Fukien, June 11, 1942 (Maa), in Maa collection; 1♀, Ta-chu-lan, Shaowu Hsien, Fukien, May 6, 1943 (Maa), in Museum of Comparative Zoology; 1♀, same collecting data, in Cheng Collection, Taipeh.

I have named this species in honor of Dr. Hsiu Fu Chao, who has been so kind as to allow me to borrow the material from the Museum of National Foochow University.

This species, having brown and extensive markings, is easily recognized by its double hyaline spots of the apical band and the small V-shaped internal skeleton of the female.

Neopanorpa latipennis Cheng

Figures 199, 203, 297

Neopanorpa latipennis Cheng, 1949, Psyche, **56**(4):156, figs. 39, 40, 55.

Body deep brown, black above, vertex black anteriorly, brown posteriorly, with a sooty brown marking on the median portion; rostrum brown, with a sooty brown median stripe on its lower portion. Fore wing: length, 14 mm.; width, 3.53 mm.; membrane hyaline, markings sooty brown; pterostigmal band very broad, with broad basal branch and narrower apical branch; basal band narrow and uneven, extending to the median portion of the wing; apical band large, represented by a big marking and an inner small Y-shaped band, the latter connected with the former to form a large hyaline spot; marginal spots small; pterostigma prominent; the wing apex rather broad. Hind wing: length, 12.55 mm.; width, 3.5 mm.; similar to fore wing, except

that the apical branch of the pterostigmal band, the inner small Y-shaped band of the apical band and the basal band are greatly reduced. Female genitalia: subgenital plate abruptly narrow posteriorly, with a wide U-shaped distal incision; internal skeleton small, being U-shaped, with a rather long stalk at its base, the axis apparently absent.

Male unknown.

Holotype (♀): Moupin, Sikang, July 29, 1941 (Chuan Lung Lee); in Cheng Collection, Taipeh.

This species, having a large hyaline spot in the posterior part of the apical band of the fore wing, differs from the other described *Neopanorpa* by the shape of the internal skeleton of the female.

Neopanorpa carpenteri n. sp.

Figures 176, 180, 300

Neopanorpa cavalerici Navas, Carpenter, 1945, Psyche, **50**(1-2):74, text figs. 4, 7.

Head chestnut brown, vertex with blackish brown spot between ocelli; rostrum chestnut brown with reddish brown tip; thorax and abdomen blackish brown dorsally, reddish brown ventrally. Fore wing: length, 15 mm.; width, 3.7 mm.; membrane light yellow, markings sooty brown; pterostigmal band complete, with broad basal branch and narrower apical branch; basal band narrow, uneven; apical band large, with a large hyaline spot posteriorly and an oblique prolongation in the middle, not connected along the anterior margin with the pterostigmal band; basal spot absent; marginal spot appears as a long and narrow band and is connected to the basal band at the middle of the wing; pterostigma prominent; longitudinal veins and basal crossveins blackish brown, apical crossveins not very distinct, R_{2a} simple, not forked. Hind wing: length, 13.5 mm.; width, 3.8 mm.; similar to fore wing, except that the apical band is interrupted posteriorly, the basal band is reduced to one spot on the hind margin of wing and the marginal spot is entirely absent. Female genitalia: subgenital plate rather broad, with shallow V-shaped distal incision; internal skeleton small, with blade-like and twisted posterior arms, no true axis present.

Male unknown.

Holotype (♀): Yim-na-shan, East Kwangtung, June 16, 1936 (L. Gressitt); in Museum of Comparative Zoology.

Distribution: same as holotype.

I take the liberty of naming this species in honor of Professor F. M. Carpenter. The species resembles *Neopanorpa cavaleriei* in appearance, but differs in the apical band of the fore wing. In *cavaleriei*, the apical band is interrupted posteriorly and is connected along the anterior margin with the pterostigmal band, whereas that of this species is not interrupted, has a large hyaline spot and is separated from the pterostigmal band on the anterior margin of the wing. The R_{2a} vein of *cavaleriei* is forked into R_{2a1} and R_{2a2}, whereas that of this species is simple. Moreover, the basal band of *cavaleriei* is interrupted, whereas that of this species is complete and distinct.

Genus LEPTOPANORPA McLachlan

Leptopanorpa McLachlan, 1875, Trans. Ent. Soc. London, 1875:187. Weele, 1909, Notes Leyden Mus., **31**:11. Enderlein, 1910, Zool. Anz., **35**:393. Miyake, 1913, Journ. Coll. Agr. Imp. Univ. Tokyo, **4**:381. Esben-Petersen, 1913, Notes Leyden Mus., **35**:228. *Id.*, 1921, Coll. Zool. Selys Long. **5**(2):85. Lieftinck, 1936, Treubia, **15**(3):271.

Himantarella Enderlein, 1910, Zool. Anz., **35**:392.

Neopanorpa Enderlein, 1912, Notes Leyden Mus., **34**:237 (*nec* Weele).

Rostrum long and slender; tarsal claws serrated on inner margins; wings are fully developed, slender and narrow, especially at the base; 1A short, extending to the anal margin of wing far before origin of the radial sector; abdomen very long and slender in male, much longer than the wings; 6th to 8th abdominal segments of male much prolongated; genital bulb of male with a narrow stalk basally (pedunculate).

Genotype: *Leptopanorpa ritsemae* McLachlan.

This genus, which inhabits mostly southeast Asia, especially Japan and Java, is represented in China by only one species. *L. javanica* (Westwood); the Chinese locality of this species is Hainan, an island, which is separated from the mainland by a narrow sea.

The most obvious difference between *Leptopanorpa* and *Neopanorpa* is the length of the last four abdominal segments of the

male. However, the genital structures of both the male and the female of *Leptopanorpa* are quite close to *Neopanorpa*. In some species of *Leptopanorpa*, e.g., *longicauda*, the last four abdominal segments of the male are exceedingly long, in others, e.g., *erythrura*, they are rather short. It seems to me that there is no distinct difference between *Leptopanorpa* and *Neopanorpa*. Whether or not this characteristic (prolongation of the last four abdominal segments of the male) is of generic significance is not certain. A morphological study of the larva of this genus and that of *Neopanorpa* would be a great help in settling the question. A knowledge of the life history and feeding habits of the *Leptopanorpa* is also very desirable.

Leptopanorpa javanica (Westwood)

Figures 228, 229

Leptopanorpa javanica (Westwood) Esben-Petersen, 1913, Notes Leyden Mus. **35**:229. *Id.*, 1915, Ent. Medd., **10**:231, cat.-no. 9. *Id.*, 1921, Coll. Zool. Selys Long., **5**(2):89, fig. 100. Lieftinck, 1936, Treubia, **15**(3): 315, pls. 6, 7, 10, 12, 14.

Panorpa javanica Westwood, 1846, Trans. Ent. Soc. London, **4**:186. *Id.*, 1852, Trans. Ent. Soc. London, **1**(2):5. Walker, 1853, Cat. Neur. Ins. Brit. Mus., 1853:460. Weele, 1909, Notes Leyden Mus. **31**:6.

Campodotecnum javanicum Enderlein, 1910, Zool. Anz., **35**:391. *Id.*, 1912, Notes Leyden Mus., **34**:236.

Head black; rostrum reddish brown; thorax black above, sides grayish testaceous to pitchy black; abdomen of female black above, terminal segments and the venter paler; 1st to 5th abdominal segments of male black, last few segments dark pitchy brown; the hind border of third tergite extending into a slender cylindrical prolongation which reaches the middle of next segment, where a tubercle is found; 6th segment cylindrical, 7th and 8th slender, much thinner than 6th, of equal length and one and a half times longer than 6th; their apical part gradually incrassate towards the apex, which is obliquely truncated above; 9th segment pedunculate. Fore wing: length, 9-10.5 mm.; slender with elliptical apex; membrane whitish, markings sooty black; pterostigmal band complete, with a broad basal branch and a very narrow apical branch; basal band interrupted, represented by two spots; apical band broad, with nearly straight inner

margin, sometimes enclosing a whitish spot in its posterior part; along the front margin it is narrowly connected with the pterostigmal band; basal spot absent; marginal spot present; pterostigma not prominent. Hind wing: length, 8-9 mm.; similar to the fore, except that the basal band is represented by only one spot. The male genitalia have been figured out by Lieftinck. According to his drawings, the genital bulb is slender; coxopodites rather long, with truncated apex; harpagones long, slender, smoothly incurved at apices, the outer margin slightly concave near the base, the inner margin with a basal rounded tooth and two lobes, opposite each other; hypandrium conspicuous, broad; hypovalvae broad, with rounded apex, reaching beyond the base of harpagones, the distal portion of hypovalvae coming into contact with each other; parameres simple, with slender and twisted stalk and a greatly enlarged apical portion (if I understand Lieftinck's drawing correctly); preëpiproct with rounded tip; aedeagus with well developed and stout apical processes; lateral processes curved backward and inward with broad apex. The internal skeleton of the female genitalia has been figured by Lieftinck. According to his drawing, the internal skeleton is very short and comparatively broad; the basal portion of the plate is in the form of two wing-like structures, which are rather twisted and turned dorsad; mesially the two portions converge and are connected with each other by a thin membrane; the distal portion of the plate well demarcated; posterior arm of the plate short, with tooth-like apex; axis not present.

Types (♂ , ♀): Java (D. Horsfield); in Mus. Soc. Merc. Ind. Orient.

Distribution: Mt. Wuchi, Hainan, Kwangtung, May 21, 1903; Leito, Burma (Leonardo Fea); Carin Chebai, Burma (900-1100 m.), Dec. 5, 1888 (Leonardo Fea); Sumatra (Ericson); Java (Horsfield); Banjoemas, Noesa, Mid. Java, no. 10, 1925-1928 ("teak forest," L. G. E. Kalshoven); coastal forest around Sempoertjondong (Tjidaoen), 100 m., S. W. Java, Sept. 5, 1935 (Max Bartels, Jr.).

This is the only known species in China. It resembles *L. peterseni* Lieftinck (East Java) in body and wing color. However, according to Lieftinck's drawings, the male genitalia of this species are quite different from those of *peterseni*, especially the

shape of the hypovalvae. The axis of the female internal skeleton of this species is apparently absent, whereas that of *peterseni* is well developed.

Family BITTACIDAE

Bittacidae Enderlein, 1910, Zool. Anz., **35**:387. Esben-Petersen, 1921, Coll. Zool. Selys Long. **5**(2):115, fig. 126. Carpenter, 1931, Bull. Mus. Comp. Zool., **72**(6):257.

Ocelli present; labial palpi two-segmented; abdomen narrowly cylindrical; females without ovipositor; terminal segments of male only slightly modified; legs tenuate, with a single tarsal claw, modified for grasping; wings usually subpetiolate, slender; costal space narrow, with few crossveins; R_s originating at two-fifths to one-half the wing length from base; M dividing near the middle of the wing.

Bittacus is the only one of the six existing genera of the family which inhabits China.

Genus BITTACUS Latreille

Bittacus Latreille, 1805, Hist. Nat. Crust. et Ins., **8**:20. *Id.*, 1807, Gen. Crust. et Ins., **3**:189. Klug, 1836, Abh. Königl. Akad. Wiss. Berlin, 1836:97. Burmeister, 1839, Handb. Ent., **2**:955. Rambur, 1842, Hist. Nat. Ins. Nevr., 1842:326. Brauer, 1855, Verh. Zool.-bot. Ges., **5**:707, pl. 2. *Id.*, 1863, Verh. Zool.-bot. Ges., **21**:109, p. 3. Brauer and Löw, 1857, Neuropt. Austr., 1857:36. Felt, 1896, New York State Ent. Rep., **10**:463, pls. 3, 4. Hine, 1898, Journ. Columb. Horticult. Soc., **12**:105, pls. 1, 2. McClendon, 1906, Ent. News, 1906:121, fig. 15. Klapálek, 1910, Acta Soc. Ent. Bohem., **7**:114. Enderlein, 1910, Zool. Anz., **35**:396. Esben-Petersen, 1913, Revue Zool. Afr., **3**:135. Banks, 1913, Trans. Amer. Ent. Soc., **39**:233. Lestage, 1917, Revue Zool. Afr., **5**:112. Esben-Petersen, 1921, Coll. Zool. Selys Long., **5**(2):117. Carpenter, 1931, Bull. Mus. Comp. Zool., **72**(6):257.

Leptobittacus Hine, 1898, Journ. Columb. Horticult. Soc., **12**:108.

Thyridates Navas, 1908, Mem. Real. Acad. Ciene. Art. Barcelona, 1908:412.

Diplostigma Navas, 1908, Mem. Real. Acad. Ciene. Art. Barcelona, 1908:413.

Haplodictyus Navas, 1908, Mem. Real. Acad. Ciene. Art. Barcelona, 1908: 413. *Id.*, 1908, Rev. Russe d'Ent., 1908:277.

Eyes widely separated below antennae; basal segment of hind tarsus longer than fourth segment; wings present, their mark-

ings appearing as spots, without bands; one costal crossvein; 1A of hind wing coalescing with Cu_2 for a short distance.

Genotype: *Bittacus italicus* O. F. Müller.

This is the second largest genus of Mecoptera, including sixty-two known species in the whole world. Seven species have already been recorded in China and four new ones are described below, making a total of eleven. They are widely distributed in that country. Although only eleven species have been found, the localities cover the whole mainland of China, that is, from northern Shensi, Liaoning (one province of Manchuria) to southern Kwangtung, Yunnan, and from western Sikang to eastern Kiangsu. Some species, e.g., *sinensis* Walker, besides being common in Kiangsu, Chekiang, have also been recorded in Korea and Japan.

In the classification of the species of *Bittacus*, the chief characteristics which have been used are the body structure and wing coloration. In some species, the wing membrane is yellow (*sinensis*, etc.), in others, light brown (*sinicus*, etc.). The size of the wing affords some specific characters; in *appendiculatus*, the fore wing is shorter than 17 mm., whereas that of *sinensis* is longer than 24 mm. The apex of the wing of most species is obtusely angulated, but in *carpenteri* n. sp., it forms nearly a right angle, forming a prominent corner. The wing markings usually appear as several small spots. They are present in all the species, except *planus* and *appendiculatus*. Most of the venational characteristics are subject to individual variation. However, there are some venational features which are of use and value in the determination of species, especially for the female: the position of the ending of 1A and that of cubital crossvein (Cuv) with respect to the fork of media (M); the presence or absence of the anal crossvein (Av); and the number of pterostigmal crossveins (Pcv).

Another important characteristic is the structure of the male genitalia, which are not so complex as those of Panorpidae. The tergum of the 9th abdominal segment is deeply cleft posteriorly, forming a pair of claspers. The shape of this appendage varies in different species. Seen from the side, it is triangular in some species (*triangularis*, fig. 233) and subquadrangular in others (*sinicus*, fig. 245). Some species have a caudal incision in each

of the claspers (*sinensis,* fig. 235), whereas others have a single long process (*carpenteri* n. sp., fig. 246). In most species, the posterior parts of the inner surface of the claspers have a patch of short, stout, sooty-brown bristles (*sinensis,* etc., fig. 255), others have no bristles at all (*carpenteri* n. sp., fig. 256), and others have two to three bristles which are borne on lobes attached to the median, inner surface of the claspers. The sternum of the 9th segment is a simple semicircular plate. It is not of much use for identification. The coxopodites are reduced, mostly fused with the 9th sternum. The harpagones are also greatly reduced. However, the shape of this small appendage varies in different species. In some species, the outer margins of the harpagones are concave (*sinicus,* etc., fig. 249) and in others convex, forming a prominent process (*pieli,* fig. 250). Some appear as an inverted boot, others have a long and slender distal process (*planus,* fig. 248). Extending upward between the coxopodites is a long coiled spiral filament or filum. A pair of prominent lobes, the aedeagus lobes, project upwards on each side of the base of the filament. In some species, they are long and slender (*tienmushana* n. sp., fig. 268) and in others short and stout (*pieli,* fig. 250). Some have a rounded apex (*sinensis,* fig. 270), others have the apex truncated (*planus,* fig. 248). The proctiger which extends dorso-caudad between the preëpiproct and the coxopodites affords some taxonomic value. In some species, it is long and slender (*carpenteri* n. sp., fig. 262) and in others short and stout (*gressitti* n. sp., fig. 254). Some have a pair of lateral lobes at the middle (*coreana,* fig. 240), while others have a pair of long processes on the dorsal part of the apex (*tiennmushana* n. sp., fig. 263). The lower process of the proctiger varies much in degree of development. In some species, it is very long (*carpenteri* n. sp., fig. 262), in others, it is very short (*gressitti* n. sp., fig. 254).

The females of *Bittacus* seem to have lost the internal skeleton which is so useful in the taxonomy of the Panorpidae. The subgenital plate is not well-developed, and no taxonomic value can be found. Therefore, the identification of females is based only upon the general body and wing characteristics.

Key to the Species of Bittacus

1. Wing membrane yellowish 2
   Wing membrane light brown or brown 6
2. Fore wing length shorter than 17 mm. or longer than 24 mm. 3
3. Wing membrane slightly yellowish; length of fore wing shorter than 17 mm.; preëpiproct extending upward, with pointed dorsal process and an upwardly curved caudal process ..... *appendiculatus*
   Wing membrane strongly yellowish; length of fore wing longer than 24 mm.; preëpiproct extending posteriorly, deeply cleft at the apex, with upper branch and lower branch ..... *sinensis*
4. Preëpiproct cleft at the apex, the upper branch less developed, lower branch elongated, broadening towards its apex which is curved inwards; proctiger with a pair of median lateral lobes ..... *corcanus*
   Preëpiproct not cleft at the apex 5
5. Preëpiproct triangular when viewed from side; proctiger with a pair of side lobes located close to its apex ..... *triangularis*
   Preëpiproct not triangular when viewed from side, with more or less truncated posterior margin; proctiger without paired side lobes .... *planus*
6. Prëpiproct more or less triangular when viewed from side 7
   Preëpiproct not triangular when viewed from side 8
7. The posterior part of the ventral portion of preëpiproct extends posteriorly to form a process; aedeagus lobes long, with rather sharp tips; dorsal apical half of proctiger with a pair of side lobes .... *zoensis* n. sp.
   The posterior part of the ventral portion of preëpiproct less extended; aedeagus lobes very long, with truncated apex; dorsal apical part of proctiger with a pair of processes ..... *tienmushana* n. sp.
8. Preëpiproct with prominent posterior process when viewed from side..9
   Preëpiproct without posterior process when viewed from side 10
9. Prëepiproct irregularly quadrangular when seen from side, with a very long posterior process at the dorsum of its posterior margin; both proctiger and lower process long and slender; apices of wings appearing as a right angle..... *carpenteri* n. sp.
   Preëpiproct more or less quadrangular when seen from side, with the caudal margin cleft, the upper branch short, while the lower branch greatly extends posteriorly to form a process with rounded tip; both proctiger and lower process short and stout; apices of wings not appearing as a right angle ..... *gressitti* n. sp.
10. Preëpiproct subquadrangular, no lobes at its inner side; outer margins or harpagones not convex ..... *sinicus*
    Preëpiproct irregular in shape, with two lobes on its median inner side; outer margins of harpagones very much convex ..... *pieli* n. sp.

Descriptions of Species of Bittacus

Bittacus appendiculatus Esben-Petersen

Figure 230

Bittacus appendiculatus Esben-Petersen, 1927, Notul. Ent. **7**:14, figs. 3, 4.

Body brown; vertex with a black spot enclosing ocelli. Fore wing: length, 16 mm.; rather narrow, with smoothly angulated apex; membrane with yellowish tinge, no markings present; veins brown, Sc terminating near the middle of the costal margin. 1A very short, ending on the anal margin far before the level of the fork of M; cubital crossvein (Cuv) present, located before the fork of media; no anal crossvein (Av) present; pterostigma prominent, short, almost triangularly shaped, yellowish brown, connected with R_s by one pterostigmal crossvein (Pcv). Hind wing: length, 16 mm.; similar to the fore, except that the first anal is a little longer. Male genitalia: I have not seen this species; however, according to Esben-Petersen's drawing, the preëpiproct is very broad and short in lateral view, extending upwards, rather than posteriorly, with a prominent pointed dorsal process; the anterior margin of the preëpiproct is strongly sinuous, the posterior margin straight, with upwardly curved posterior processes which extend from the lower margin of the preëpiproct; coxopodites prominent, harpagones ax-shaped; both proctiger and lower process narrowed towards apex.

Type (♂): San-nen-kai, Yunnan; in Esben-Petersen Collection, Silkeborg.

Distribution: same as type.

This species, having light yellowish wing membranes, differs from the other described *Bittacus* by the dorsally extended preëpiproct of the male genitalia.

Bittacus sinensis Walker

Figures 235, 237, 255, 270, 303

Bittacus sinensis Walker, 1853, Cat. Neur. Ins. Brit. Mus., 1853:469. McLachlan, 1887, Mitt. Schweiz. Ent. Ges., 1887:406. Miyake, 1913, Journ. Coll. Agr. Imp. Univ. Tokyo, **4**:386. Navas, 1913, Notes d'Ent. Chin. 1(7):4. Esben-Petersen, 1921, Coll. Selys Long., **5**(2):121, figs. 132, 133. Okamoto, 1925, Bull. Agr. Exp. Sta. Gov. Chosen, **2**(1):8.

Diplostigma sinense Navas, 1908, Mem. Real Acad. Ciene. Art. Barcelona, 1908:413. *Id.*, Rev. Russe d'Ent., 1909:277.

Bittacus quaternipunctatus Enderlein, 1910, Zool. Anz., 1910:397. Miyake, 1913, Journ. Coll. Agr. Imp. Univ. Tokyo, **4**:387. pl. 33, fig. 6, pl. 37 fig. 10.

Bittacus strategus Navas, 1913, Bull. Mus. d'Hist. Nat., Paris, 1913:442, figs. 2a, 2b.

Head pale brown, vertex with black spot between ocelli; rostrum fuscous with paler tip; thorax and abdomen pale brown. Fore wing: length, 24-26 mm.; width, 6-6.3 mm.; rather broad with more or less rounded apex; membrane strongly yellowish, with four minute dark brown spots, one at the fork where M separated from Cu_1, one at the base of R_s, one at the subcostal crossvein (Scv) and one at the first fork of R_s; veins yellowish brown, 1A terminating at the level of the fork of M, some of the crossveins in the apical part faintly and narrowly brownish shaded; both cubital crossvein (Cuv) and anal crossvein (Av) present, the former a little beyond the fork of media; pterostigma rather prominent, subquadrangular, yellowish, connected with R_s by one or two pterostigmal crossveins (Pcv). Hind wing: length, 21-23 mm.; width, 5.5-6 mm.; similar to fore wings. Male genitalia: the dorsal margin of the preëpiproct when viewed from side, convex, deeply cleft at the tip; lower branch of this cleft larger than the upper one, curved inwards, both lower and upper branches with rounded apex and with a series of short black bristles on their interior side; caudal end of coxopodites concave; harpagones short, with inner process; aedeagus lobes on each side of the base of filum (spiral filament) narrow and slender; proctiger rather truncated at the apex, furnished with a bundle of hairs, no lateral lobe present; lower process also truncated at the apex.

Type (♀): Shanghai, China (Saunders 68:3); in the type-series of Walker, Museum of London.

Distribution: same as type: Soochow (Wuhsien), Kiangsu; Shanghai, Kiangsu; Chusan, Chekiang, June 3-4, 1934-35; Suigen, Korea, June to July, 1922; Shakuofi, Korea, July, 1922; Tokyo, Japan.

This species differs from other described *Bittacus* by its strongly yellowish wing membrane. The apex of the preëpiproct of this species is deeply cleft as in *B. coreanus* Issiki, but the

upper branch of this species is more developed than that of *coreanus*.

Bittacus coreanus Issiki

Figures 234, 240, 247, 251, 309

Bittacus coreanus Issiki, 1929, Trans. Nat. Hist. Soc. Formosa, **19**(102): 304, text-fig. 20.

Head brownish yellow, the area between the ocelli blackish; rostrum fuscous, with yellowish tip; thorax and abdomen yellowish brown or grayish brown, each basal tergite of abdomen with a very narrow, black, median, transverse band on the hind border. Fore wing: length, 22 mm.; width, 5.5 mm.; broadened towards the apical area, with obtuse tip; membrane with yellowish tinge; markings appear as minute blackish brown spots, four in number, one at the fork where M separates from Cu, one at the base of R_s, one at subcostal crossvein (Scv) and one at the first fork of R_s; besides these, there is a very feeble spot at the fork of R_{4+5}; of all the spots, the first two are more distinct; veins brown, some of them yellowish; 1A ending on the anal margin a little beyond the fork of M; crossveins in the apical part of wing faintly and narrowly brownish shaded, cubital crossvein (Cuv) a little beyond the fork of media, anal crossvein (Av) between Cu_2 and 1A absent; pterostigma not prominent, connected with R_s by two crossveins (Pcv). Hind wing: length, 20 mm.; width, 4.7 mm.; similar to fore wings. Male genitalia: the dorsal margin of preëpiproct more or less rounded when viewed from side, deeply cleft at the tip, lower branch of this cleft elongated, broadened towards apex, curved inwards, with a series of short black bristles on the interior side of the tip, upper branch also with short black bristles on the interior side of its apex; caudal end of coxopodites with V-shaped distal incision; harpagones short, with inconspicuous inner processes; aedeagus lobes on each side of the base of filum (spiral filament) short and broad, with rounded tips, reddish brown; proctiger truncated at the apex, the latter furnished with a few short hairs on its dorsal corner; at the middle of proctiger is a pair of lateral lobes, furnished with very short hairs; lower process short and narrowed towards apex.

Type (♂): Keizyo, Korea, June 24, 1926 (Issiki); in Issiki Collection.

Distribution: same as type; Suigen, Korea, June 23, 1926 (Issiki); Shanghai, Kiangsu, China, June 16-22, 1931-1933; Zikawei, Shanghai, Kiangsu, China, July 17, 1938 (Piel).

This species has previously been known only from Korea.

Coreanus, having a yellowish wing membrane, differs from other described *Bittacus* by the peculiar shape of its preëpiproct, which is deeply cleft at the tip; the upper branch of this cleft is short, the lower branch elongate, broadening towards the apex and curved inwards. The paired median lateral lobes of the proctiger also make its recognition easy.

Bittacus triangularis Issiki

Figures 233, 241, 252, 267, 310

Bittacus triangularis Issiki, 1929, Trans. Nat. Hist. Soc. Formosa, **19**(102): 306, text-fig. 21.

Body pale yellowish brown; vertex yellowish brown, with blackish brown marking between the ocelli and also between the antennae; rostrum blackish brown, with yellowish tip; the basal segments of the abdomen have very narrow blackish hind margin above. Fore wing: length, 20-21 mm.; width, 5.7 mm.; the wing apex rather obtuse; membrane with yellowish tinge; markings very small, blackish brown, three in number, one at the fork where M separates from Cu_1, one at the base of R_s and one at the first fork of R_s; veins yellowish brown; 1A terminating on anal margin near the level of the fork of M, crossveins in the apical half narrowly and slightly shaded with brown, subcostal crossvein (Scv) shaded with dark brown, cubital crossvein (Cuv) considerably beyond the fork of media, anal crossvein (Av) absent; pterostigma not very prominent, connected with R_s by two pterostigmal crossveins (Pcv). Hind wing: length, 18-19 mm.; width, 5 mm.; similar to fore wings. Male genitalia: preëpiproct triangular when viewed from side, the hind-margin slightly emarginate at the tip, the lower side of this emargination a little produced, and its inner surface without black bristles, while the apical part of the upper side has short black bristles on the inner surface; distal end of coxo-

podites conspicuously produced; harpagones comparatively long, with rounded tips; aedeagus lobes on each side of the base of filum (spiral filament) grayish yellow, rather long and broad, with rounded tips; apex of proctiger rounded, with long dense hairs; very close to the apex there is a pair of side lobes, which are furnished with soft hairs; the lower process long, well developed, with a few inconspicuous hairs on the dorsal surface.

Type (♂): Moukden (Shenyang), Liaoning, (one province of Manchuria), July, 1916 (A. Nohira); in Issiki Collection.

Distribution: same as type; Keizyo, Korea, June 24, 1926; Moukden, Liaoning, Aug., 1916.

This species, having a yellowish wing membrane, differs from the other described *Bittacus* by its triangular preëpiproct in side view and the peculiar structure of the proctiger.

Bittacus planus Cheng

Figures 239, 244, 248, 258, 305

Bittacus planus Cheng, 1949, Psyche, 56(4):158; figs. 59, 60, 61, 63, 67.

Body light brown, vertex brown, with a sooty brown marking enclosing ocelli; rostrum brown; mesothorax with two sooty brown spots on each side dorsally. Fore wing: length, 20.2 mm.; width, 5.2 mm.; the wing apex rather broad, apex obtusely angulated; membrane light yellowish brown, without markings; veins brown, 1A terminating a little before the level of the fork of M, crossveins very slightly emarginate, cubital crossvein (Cuv) located beyond the level of the fork of M, no anal crossvein (Av) present; pterostigma not very prominent, connected with R_s by two pterostigmal crossveins (Pcv). Hind wing: length, 17.5 mm.; width, 4.2 mm.; similar to fore wings, except that there is only one pterostigmal crossvein (Pcv). Male genitalia: preëpiproct with V-shaped inner margins when seen from above, with truncated apex; the apical margins slightly concave, furnished with a series of short black bristles on its inner sides; posterior end of coxopodites extending upward for a considerable distance, with smooth apex; harpagones broad basally, very narrow and slender distally, with prominent inner process; aedeagus lobes on each side of the base of filum (spiral filament) broaden towards apex, furnished with a bundle of

short hairs; the lower process very long, pointed towards its apex.

Holotype (♂): Mt. Taipai, Shensi, June, 1942 (Io Chou); in Cheng collection, Taipeh.

This species, having a yellowish brown wing membrane, differs from the previously described species by the more or less truncated caudal margins of the preëpiproct in lateral view. The slender harpagones and the broadened apex of the aedeagus lobes also make its recognition easy.

Bittacus zoensis n. sp.

Figures 231, 253, 257, 265, 306

Body brown, vertex deep brown, with sooty brown marking enclosing ocelli; rostrum blackish brown. Fore wing: length, 23.5 mm.; width, 5.8 mm.; rather broad, with obtusely angulated apex; membrane light brown, with six minute blackish brown spots; one at the fork where M separates from Cu_1, one at the base of R_s, one at the first fork of R_s, one at the subcostal crossvein (Scv), one at the fork of R_{4+5} and one at the pterostigmal crossvein (Pcv); veins brown; 1A terminating before the level of the fork of M, crossveins slightly shaded with brown, cubital crossvein (Cuv) one or two, located in the level of the fork of M, no anal crossvein (Av) present; pterostigma not prominent, connected with R_s by one or two pterostigmal crossveins (Pcv). Hind wing: length, 21 mm.; width, 5.4 mm.; similar to fore wings, except that both cubital and pterostigmal crossveins are represented by one crossvein. Male genitalia: preëpiproct equilaterally triangular when seen from side, the caudal margins slightly convex at the middle, the posterior parts of the ventral margin extending backward to form a prominent process; at the inner surface of the angle between the above margins are short black bristles; coxopodites slightly curved upward with emarginate apex; harpagones short, with rounded tips, the median inner margin with inner processes; aedeagus lobes on each side of the base of filum (spiral filament) rather long with rather sharp tips; proctiger with truncated apex, furnished with a bundle of brown hairs; on its apical half there is a pair of prominent side lobes, furnished with a row of long brown

bristles; the lower process rather short, pointed towards its apex.

Holotype (♂): Zo-se, Chungkiang-Hsien, Kiangsi; June 5, 1934; in Heude Museum, Shanghai. Paratypes: 1♀, same collecting data as holotype; in Museum of Comparative Zoology; 1♀, same collecting data as holotype; in Cheng Collection, Taipeh.

The male of this species has a triangular preëpiproct, as seen in lateral view, as in *Bittacus triangularis* Issiki, but the more equilateral form of the preëpiproct, the stout harpagones and the light brown wing membrane make its recognition easy.

Bittacus tienmushana n. sp.

Figures 232, 259, 263, 268, 304

Body blackish brown, vertex brown, with a black marking within ocelli; rostrum reddish brown. Fore wing: length, 25.5 mm.; width, 6 mm.; rather broad, with obtusely angulated apex; membrane light brown, with three minute blackish brown spots, one at the fork where M separates from Cu_1, one at the base of R_s and one at the first fork of R_s; veins brown; 1A terminating at the level of the fork of M, crossveins slightly shaded with brown, cubital crossvein (Cuv) located in the level of the fork of M, no anal crossvein (Av) present; pterostigma not very prominent, connected with R_s by two pterostigmal crossveins (Pcv). Hind wing: length, 21.5 mm.; width, 5.5 mm.; similar to fore wings. Male genitalia: preëpiproct equilaterally triangular when seen from side, the caudal parts of the ventral margins very slightly produced behind; at the inner surface of the lower area of the caudal margin are short black bristles; coxopodites slightly produced; harpagones short, inverted boot-shaped; aedeagus lobes on each side of the base of filum (spiral filament) long, with truncated apex and irregular outer margins; proctiger cone-shaped, with truncated apex; on the dorsal part of the apex, there is a pair of prominent long processes; the lower process rather long, pointed towards its apex.

Holotype (♂): Tien-mu-shan, Chekiang; July 11, 1936; in Museum of Institute of Zoology, Academia Sinica, Shanghai. Paratypes: 1♀, same collecting data and same location as holotype; in Museum of Comparative Zoology; 1♀, same collecting data as holotype; in Cheng Collection, Taipeh.

This species, having a light brown wing membrane, differs from *Bittacus zoensis* n. sp. by its less extended processes in the caudal-ventral portion of the preëpiproct.

Bittacus carpenteri n. sp.

Figures 246, 256, 262, 269, 307

Body light brown; vertex brown, with a deep brown marking enclosing ocelli; rostrum brown. Fore wing: length, 21.5 mm.; width, 5.5 mm.; narrow, with right angulated apex; membrane light brown, with several minute dark brown spots, one at the fork where M separates from Cu_1, one at the base of R_s, one at the first fork of R_s, one at the fork of R_{4+5} and one at the cubital crossvein (Cuv); veins brown, 1A terminating far before the level of the fork of M; the distal end of R_5 and most of the crossveins are heavily shaded with brown; cubital crossvein located before the fork of M, no anal crossvein (Av) present; pterostigma prominent, connected with R_s by two pterostigmal crossveins (Pcv). Hind wing: length, 17.5 mm.; width, 4.5 mm.; similar to fore wings. Male genitalia: preëpiproct irregular when seen from side, with a swollen caudal portion which has a very long caudal process; coxopodites with concave apex; harpagones very small, inwardly bent; aedeagus lobes on each side of the base of film (spiral filament) narrowed towards apex, with truncated tips; proctiger very long, slender at the middle portion, with enlarged apex which is furnished with a row of hairs; the lower process very long, pointed towards its apex.

Holotype (♂): Mt. Omei (11,000 ft.), Szechwan; July 21, 1935; D. C. Graham; in Museum of Comparative Zoology.

I take the liberty to name the species in honor of Professor F. M. Carpenter, who has allowed me to describe the species.

This species, having a light brown wing membrane, is easily distinguished from the other described *Bittacus* by the apex of the wing forming nearly a right angle and the long posterior processes of the preëpiproct. The very long and slender proctiger and lower process also make its recognition easy.

Bittacus gressitti n. sp.

Figures 236, 254, 260, 266, 312

Body deep brown; vertex black anteriorly; reddish brown posteriorly; rostrum blackish brown. Fore wing: length, 23.8 mm.; width, 5.3 mm.; membrane light brown, with some ill-defined reddish brown shadows along the margin of the apical portion of wing; markings minute, blackish brown, one at the fork where M separates from Cu_1, one at the base of R_s and one at the first fork of R_s; veins brown; 1A terminating at the level of the fork of M, crossveins rather heavily shaded with brown, cubital crossvein (Cuv) located a little beyond the fork of M, no anal crossvein (Av) present; pterostigma rather prominent, connected with R_s by two pterostigmal crossveins (Pcv). Hind wing: length, 21 mm.; width, 5 mm.; similar to fore wings. Male genitalia: preëpiproct U-shaped when seen from dorsal side, apparently emarginate at the tip, lower parts of this emargination much produced and not so curved inwards as in *Bittacus chujoi* Issiki and Cheng; upper parts short and thick; both the lower and upper parts are furnished with short black bristles on the interior sides; harpagones longer than that of *chujoi,* with broad bases, rounded tips and small inner processes; aedeagus lobes on each side of the base of filum (spiral filament) slender, pointed towards apex in caudal view; proctiger with its posterior half bent upward; apex truncated, with only very minute hairs; close to the apex there is a prominent side lobe covered with many soft hairs. Lower process short, but apparently present.

Holotype (♂): Yim-na-shan, E. Kwangtung; June 12, 1936; L. Gressitt; in Museum of Comparative Zoology. Paratypes: 5 ♀ ♀, same type locality and deposition as holotype; June 12-17, 1936; L. Gressitt; in Museum of Comparative Zoology.

This species is named in honor of the collector, Dr. L. Gressitt. It resembles *Bittacus coreanus* Issiki in the structure of the preëpiproct, but these two species are at once distinguished by the color of the wing membrane and the body size. This species is also closely allied to *B. chujoi* Issiki and Cheng from Formosa. The preëpiprocts of these two species have nearly the same shape when seen from the side. In *gressitti,* however, the lower

margins of the preëpiproct are wholly (not just partly, i.e., caudally, as in *chujoi*) folded outward and the lower process is much longer and extends straighter than that of *chujoi*. Besides this, the bare apex of the proctiger of this species is quite easy to distinguish from that of *chujoi*, which has an apical bundle of long hairs.

Bittacus sinicus Issiki

Figures 238, 245, 249, 264, 311

Bittacus sinicus Issiki, 1931, Ann. Mag. Nat. Hist., (10)7:221, fig. 2.

Head and rostrum blackish brown, posterior part of vertex paler; dorsum of thorax blackish brown, meso- and metathorax with a pale median longitudinal streak, scutella pale; abdomen blackish brown, becoming blackish towards apex, except the preëpiproct (9th tergite), which is pale brown. Fore wing: length, 17.5-19.3 mm.; width, 5 mm.; rather narrow, dilated posteriorly, apex obtusely angulated, hind margin conspicuously sinuate at the end of Cu; membrane brownish, apical margin darker; markings appear as four flecks, one at M, where it separates from Cu_1, one at the base of R_s, one at the first fork of R_s, and one at ending of Cu_2; 1A terminating on anal margin before the level of the form of M, crossveins (except in basal part of wing) shaded with blackish brown; three of these fall in a line from fork of R_{4+5} to near the end of Cu_1; passing the fork of M_{3+4}, their shading forms a narrow transverse streak; cubital crossvein (Cuv) a little before the fork of M, anal crossvein (Av) present; pterostigma rather short, not very prominent, connected with R_{2+3} by two pterostigmal crossveins (Pev). Hind wing: length, 15.5-17.5 mm.; width, 4.5 mm.; similar to fore wing. Male genitalia: preëpiproct with deep U-shaped inner margins, when seen from above, with rounded apex, viewed laterally, subquadrangular, upper and lower margin slightly concave, distal margin slightly convex, oblique and without cleft, furnished with a series of short black bristles along its inner sides; posterior end of coxopodites extending upward for a considerable distance, with emarginate apex; harpagones broad basally, narrow distally, with prominent inner process; aedeagus lobes on each side of the base of filum (spiral filament) short,

rather broad, rounded at apex; proctiger narrow, with tooth-like apex, furnished with a bundle of hairs; the lower process broad basally, narrowed towards apex.

Type (♂): Mt. Omei (4500 ft.) Szechwan, July 17, 1929 (Collector unknown); in Issiki Collection, Tokyo.

Distribution: same as type; Jihti (30 miles east of Tachienlu), Sikang, Sept. 2, 1939 (F. Y. Cheng).

This species, having a brownish wing membrane, differs from other described *Bittacus* by its subquadrangular preëpiproct (in side view) and its rather small body size.

Bittacus pieli Navas

Figures 242, 243, 250, 261, 308

Bittacus pieli Navas, 1935, Notes d'Ent. Chin. Mus. Heude, **2**(5):99, fig. 63. *Id.*, 1936, Notes, d'Ent. Chin. Mus. Heude, **3**(4):59, fig. 74.

Body dull brown; vertex with black marking enclosing ocelli; rostrum blackish brown. Fore wing: length, 22 mm.; width, 4.8 mm.; narrow and slender, with obtusely angulated apex; membrane light brown, markings grayish brown; of these markings three are prominent, one at the fork where M separates from Cu_1, one at the base of R_s and one at the first fork of R_s; the apical portion of the hind margin and the apex of wing heavily shaded with grayish brown; veins brown; 1A terminating on anal margin a little before the level of the fork of M, all the crossveins heavily shaded with grayish brown, cubital crossvein (Cuv) located a little before the fork of M, anal crossvein (Av) present; pterostigma prominent, connected with R_s by two pterostigmal crossveins (Pcv). Hind wing: length, 19.5-20 mm.; width, 4.6 mm.; similar to fore wings. Male genitalia: preëpiproct with irregular dorsal margin and inwardly curved rounded apex when seen from side; the median inner side of the preëpiproct furnished with two lobes, the dorsal one more or less elongate, with two or three short black bristles, coxopodites slightly produced upward, with emarginated apex; harpagones short, with rounded tips, the median outer margins slightly convex; aedeagus lobes on each side of the base of filum (spiral filament)rather short, with gently rounded outer margin and obtuse tips; proctiger narrowed towards apex, furnished with

a bundle of brown hairs; the lower process rather short, broad basally, pointed towards its apex.

Types (♂, ♀): Kuling, Kiangsi, Sept. 19, 1934 (Piel); in Heude Museum, Shanghai.

Distribution: same as type.

This species, having a light brown wing membrane, differs from the other described *Bittacus* by the peculiar shape of the preëpiproct, which has an irregular dorsal margin and an inwardly curved rounded apex when seen from the side. The slender and heavily marked wing also makes its recognition easy.

BIBLIOGRAPHY

CARPENTER, F. M.

1931. Revision of the Nearctic Mecoptera. Bull. Mus. Comp. Zool., **72**:205-277.

1938. Mecoptera from China, with descriptions of new species. Proc. Ent. Soc. Washington, **40**(9):267-281.

1940. A new genus of Mecoptera from Tasmania. Pap. and Proc. Roy. Soc. Tasmania, 1940:51-53.

1945. Panorpidae from China (Mecoptera). Psyche, **52**(1-2):70-78.

1948. Notes on Chinese Panorpidae (Mecoptera). Psyche, **55**:28-30.

CHENG, F. Y.

1949. New species of Mecoptera from Northwest China. Psyche, **56**:139-173.

ESBEN-PETERSEN, P.

1921. Mecoptera. Collections Zoologiques du Baron Edm. de Selys Longchamps. Catalogue systematique et descriptif. Bruxelles, 1921:1-172.

1927. New and little-known species of Mecoptera and Neuroptera in the Zoological Museum of Helsingfors. Notul. Ent., **7**:13-18.

1934. Two new species of *Panorpa* Linn. (Mecoptera). Vidensk. Medd. Dansk Naturh. Foren., **97**:211-213.

ISSIKI, S.

1927. New and rare species of Mecoptera from Corea, Formosa and Japan. Insecta Matsum., Sapporo, **2**:1-12.

1929. Descriptions of new species of the genus *Panorpa* from Japan and Formosa. Journ. Soc. Trop. Agric., **1**:182-191.

1929. Descriptions of new Mecoptera from the Japanese Empire. Trans. Nat. Hist. Soc., Formosa, **19**(102):260-314.

1931. Two new species of scorpion flies (order Mecoptera). Ann. Mag. Nat. Hist., (10)**7**:219-222.

1933. Morphological studies on the Panorpidae of Japan and adjoining countries and comparison with American and European forms. Jap. Journ. Zool., Tokyo, **4**:315-416.

Issiki, S. and F. Y. Cheng

1947. Formosan Mecoptera with descriptions of new species. Mem. Coll. Agric. Nat. Taiwan Univ., **1**(4):1-17.

Lieftinck, M. A.

1936. Studies in Oriental Mecoptera. I. The genus *Leptopanorpa* in Malaysia. Treubia, Buitenzorg, **15**:271-320.

McLachan, R.

1894. On two small collections of Neuroptera from Tachienlu, in the province of Szechwan, western China, on the frontier of Tibet. Ann. Mag. Nat. Hist., (6)**13**:421-436.

Miyake, T.

1908. A list of Panorpidae of Japan, with descriptions of ten new species. Bull. Coll. Agric. Tokyo Imp. Univ., **8**(1):1-12.

1913. Studies on the Mecoptera of Japan. Journ. Coll. Agric. Univ. Tokyo, **4**:265-400.

Navas, L.

1908. Neurópteros nuevos. Mem. Real. Acad. Cienc. Art, Barcelona, 1908:406-417.

1931. Decadas de insectos nuevos. Rev. Acad. Cienc. Madrid, **26**:75.

1934. Névroptères et insectes voisins. Notes d'Ent. Chin. Mus. Heude, **2**:95-99.

Okamoto, H.

1925. The Mecoptera of Korea. Bull. Agric. Expt. Sta. Gov. Chosen, Suigen Korea, **2**(1):1-8.

Tjeder, B.

1936. Schwedisch-chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas. 51. Mecoptera. Ark. för Zool., **27**(A):1-14.

1950. Mecopteren aus Fukien. Bonn Zool. Beitr., 1950(2-4):286-290.

Wu, C. P.

1937. Catalogus insectorum sinensium. Peiping, **3**:1263-1269.